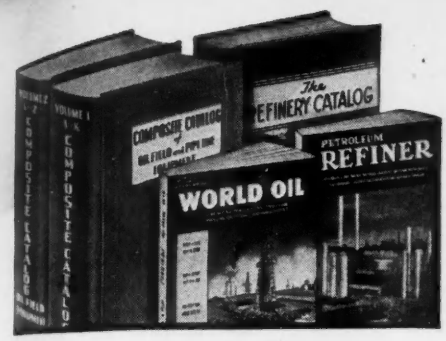

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for the refining-natural gasoline industry

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STORMY WEATHER---OR CLEARING SKIES?

WORLD OIL'S summary of the oil situation at the close of May

By RAY L. DUDLEY and WARREN L. BAKER

WORLD OIL'S barometer on the oil situation as the month of May closed showed a somewhat unsettled condition with some weather observers predicting storms while others were of the opinion that the skies were clearing.

Summed up as briefly as possible, the increase in gasoline sales has not completely offset drastically declining prices of fuel oils and seasonal increases in the stocks of such products. (Stocks of all grades of fuel oils were up May 21, over a year ago.) This has led to the feeling by refiners that profits from over-all refining operations are either too low or non-existent. Lower refinery income unquestionably is exerting heavy pressure on crude prices. How much relief might be expected for the refiners through a crude price reduction is a matter for argument because it is possible that general crude price cuts might lead to still more reductions in the price of refined oils, even gasoline, thereby further complicating the situation.

• • •

GENERALLY SPEAKING, the evidences of stormy weather are being talked about more than indications of clearer skies. A price cut becomes an accomplished fact when it is announced, but the reasoning behind a price cut may have many elements not generally known to the public or even to the oil industry. For instance, there seems little doubt that the general downward tendencies in practically all industries are having a strong psychological effect on important factors in the oil business. This is not said in a critical vein, because good business requires that a company look not only to its own affairs but, in considering its future, look to the situation among the buyers of its products.

• • •

HOWEVER, DESPITE the foregoing, and additional price cuts on heavy crudes as well as continued additions to crude stocks, some companies feel that the present economic position of the oil industry is more sound and stable than during earlier months of the year. We agree with them. Marked improvement in the refined product situation has more than offset unfavorable crude oil trends, in the opinion of many.

Reduction of crude runs to stills to low levels, plus important progress in adjustment of refinery product yields to produce larger quantities of gasoline and smaller volumes of distillate and residual fuel oils have had a most beneficial effect on the oil picture. Production of distillates and residual fuel has been consistently maintained below 1948 levels, while production of gasoline has been considerably above corresponding months of 1948. Consequently, volumes of products now being manufactured have become more "tailored" to fit today's consumption rates for various petroleum products. This situation is being contributed to by the shutting down of a number of skimming plants, which necessarily made larger amounts of heavy fuels.

As a result of the adjustment of refinery product yields and low crude runs to stills, refinery product stocks constantly compare more and more favorably with a year ago.

Gasoline stocks, which had risen to an all-time peak of 128 million barrels at the end of March, 1949, due to higher production rates, have been declining sharply. Inventories of gasoline decreased 7½ million barrels betwen the end of March and May 21, and today are but 13½ million barrels above a year ago, while they were 15 million barrels above a year ago levels at the end of March. The gasoline situation is brightened by the approach of the heavy gasoline consuming period, and stocks should continue declining. It seems safe to estimate a 5 percent increase in gasoline consumption this year over last. Estimates on total increase in consumption of all oils now range from 2 to 4 percent for the year.

• • •

RESIDUAL FUEL oil stocks east of California on May 21 were 7½ million barrels above a year ago, which represents a marked improvement since March, when they were 11 million barrels above the corresponding period of 1948. This reduction is quite significant in view of the sluggishness of the residual fuel market. Recent price reductions should result in increased demand for residual fuels.

Distillate fuel stocks east of California remain about 20 million barrels above a year ago, the same relative position they held at the end of March.

However, this is not unsatisfactory since greater burning oil consumption is expected in the 1949-1950 winter. More about this later.

• • •

THE MARKED improvement in the refined product picture shows that the industry has made much progress in solving what promised to be a serious problem. However, refiners must continue to watch their refinery runs and refinery products yields so further progress can be made. The Texas Railroad Commission could help the situation by permitting selective crude buying, something it has refused to do since the war. If refiners could obtain more high gravity oil and less heavy-gravity oil, they could make further adjustments in their yields, which would increase the output of gasoline and distillate fuel oil while reducing the amount of residual fuel oil manufactured. This probably would solve the immediate product problem, although it would be objectionable to a large group of West Texas producers. From a long range viewpoint, however, it appears probable that increased consumption of gasoline and distillate fuel oil and decreased residual fuel oil demand will make it necessary for the refining branch to install additional modern cracking facilities so the yield of lighter products can be enlarged. This necessity may develop into a trend.

• • •

LAST YEAR'S drop in consumption of fuel oils was occasioned by certain things not likely to be repeated: the maritime strike, for one, and the oil industry campaign (a successful one) of caution against the installation of oil burners because of possibility of scant supply. The industry is now actively engaged in a campaign of assurance to users and prospective users of fuel oil. Orders are being taken now with a provision that the buyer will be protected against price decreases which may come within a certain period. This is certainly a very constructive step and should mean not only long range increases in fuel oil consumption but increases in immediate deliveries from present top-heavy supplies. April sales of new fuel oil burners were up 37 percent over April of last year. A very healthy sign.

• • •

CRUDE OIL trends have not been as favorable as in refined products, despite continued reduction in production rates. Although U. S. crude production in April averaged 200,000 barrels less per day than at the end of March, and during the first two weeks of May averaged 230,000 barrels per day less than at the end of March, stocks of crude have continued to increase almost weekly. On May 14, U. S. stocks of crude oil stood at 274 million barrels, an increase of 7 million barrels since the end of March. This constituted a gain of more than 165,000 barrels daily in crude stocks since the end of March.

A factor influencing the crude oil picture was import volumes. Preliminary figures indicate crude imports have averaged slightly above 400,000 barrels daily since March, after dropping to 380,000 barrels daily during the month of March. An additional drop had been forecast for April, but preliminary figures indicate crude imports climbed to approximately 415,000 barrels daily during the month. The import question can lead to much inter-industry dissension . . . more than has been aroused in years.

• • •

RECEIPT OF a cargo of Venezuela crude at a Pacific port has aroused protests reminiscent of a similar storm occasioned several years ago by the receipt of a cargo of East Texas crude on the West Coast. A spokesman for the importing company (Shell Oil Company) said it was unable to find sufficient light oil to meet its needs, and that operation of its refineries on heavy gravity oils resulted in the production of too much residual fuel oil.

• • •

BUT WITH all the talk we cannot get away from the fact that sweet crude is not too much in supply and is very much in demand. Allowables in most states do not take into account this situation and with fuel oil selling at nearly one-half the price at which it sold a year ago, stocks of heavy crude are not considered as desirable as formerly (a temporary situation we think) with the net result that an undue proportion of crude stocks is composed of the sour or heavy oils.

• • •

OPINION DIFFERS as to the prospects for crude oil markets, with all in agreement that the next 30 to 45 days will tell the tale. Those holding a pessimistic attitude expect a 25-cent per barrel cut in sour crudes (principally West Texas) which are in the long supply due to refiners replacing them with higher gasoline-bearing oils whenever possible. Again, the Texas Railroad Commission's policy of cutting production "across-the-board" regardless of type of crude produced was aggravating the situation, creating a surplus of heavy and sour grades and a shortage of light crudes.

Optimistic observers think the demand for gasoline bearing oils so strong that light crudes might escape a price cut even if West Texas crude prices are reduced. They point out that large scale reductions in gasoline stocks in recent weeks presage increased crude runs to stills in the near future. Hence, additions to crude stocks are expected to cease.

• • •

MEANTIME, the industry's drilling program continued to run ahead of last year. Completions during the first four months of the year totaled 11,867, an increase of 676 or 6 percent over the corresponding period of 1948. (See page 50.) The industry's vigorous effort to find new sources of oil was being continued at a peak rate, wildcat completions being 18 percent greater than a year ago. (See page 87.)

Elsewhere in this issue of WORLD OIL are several articles giving detailed information on what has happened to the price of crude oil and refined products. (See page 43.)

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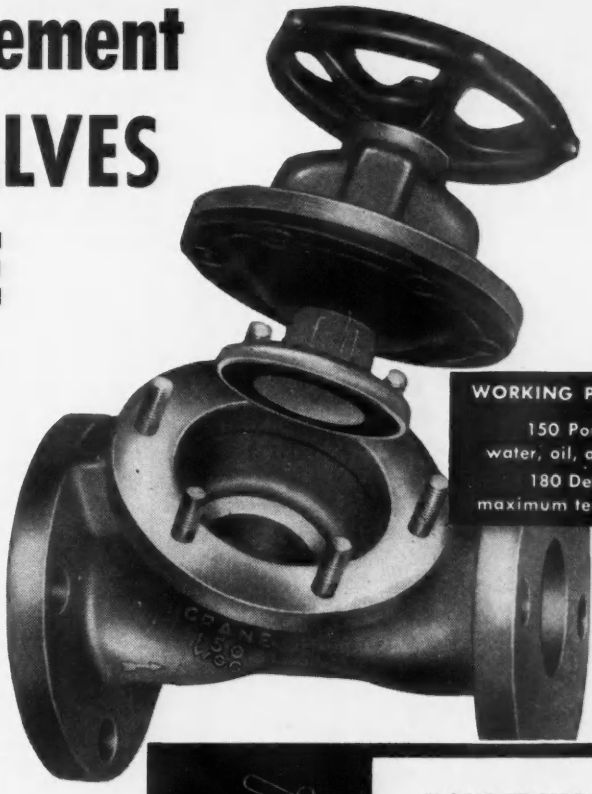

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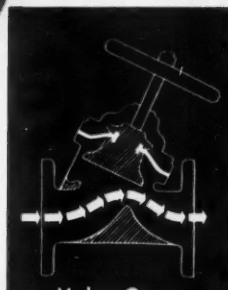

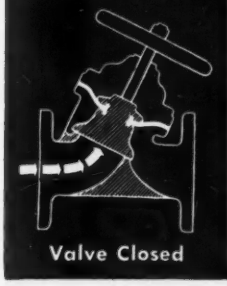

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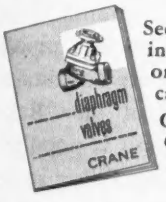

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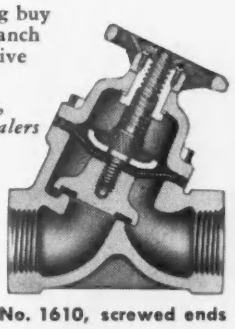
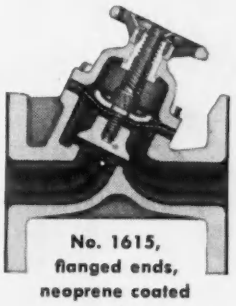


No. 1610, screwed ends



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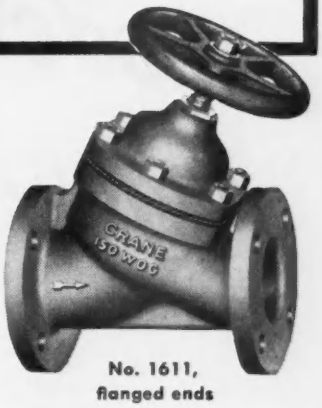

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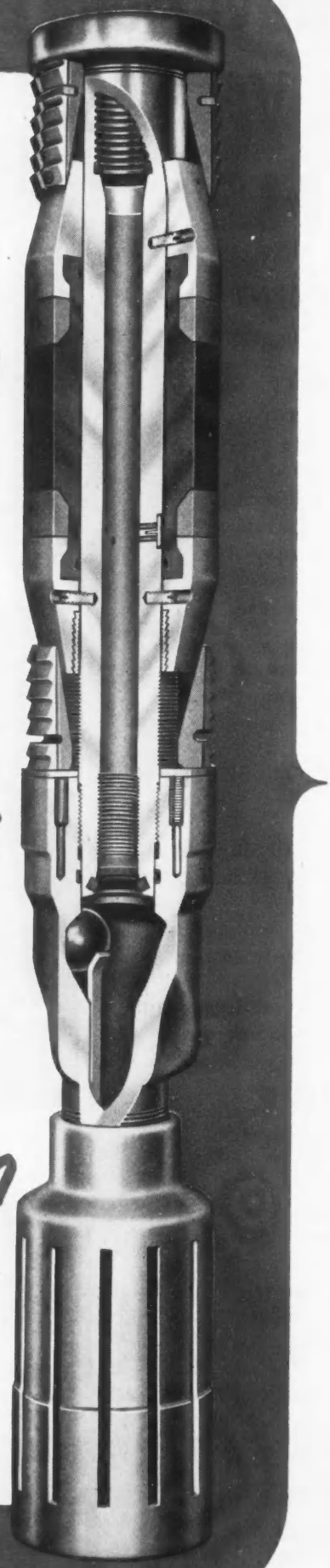

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The Changing Panorama

Industry Must Keep Informed on Demand

FORECASTS OF petroleum supply and demand have narrowed down mainly to those of the Bureau of Mines, the Independent Petroleum Association of America, and private estimates by oil company economists and others. The Interstate Oil Compact Commission heretofore made periodic forecasts through its economics advisory committee, composed principally of oil company economists. But this commission at its quarterly meeting in Jacksonville, Fla., in mid-May did not offer its usual forecast and indicated that the forecasts would be discontinued. In absence of an official explanation, it was believed that the estimates would be discontinued lest they be construed as an influence upon state oil conservation agencies in administering production regulations.

Recognition of market demand has been generally accepted as necessary for prevention of waste. State bodies must not only prevent damage to reservoirs by excessive production but also must prevent wasteful above-ground storing and evaporation and other loss of oil for which there is no market. In determining market demand, however, the Texas Railroad Commission and other state agencies never have accepted as infallible any forecasts, even those of the U. S. Bureau of Mines. They have gone directly to the market itself for guidance, giving primary consideration to crude purchasers' nominations or statements as to how much oil they require to supply their markets. Obviously, each individual purchaser is in close touch with his own markets and states his requirements as accurately as possible, wanting neither a shortage of supply for his needs nor surplus crude that he does not need.

Petroleum supply and demand actually have been remarkably well inter-related in the past several abnormal years, and the state conservation agencies are due great credit rather than criticism.

Likewise, the various official and private forecasts of supply and demand have been generally valuable in keeping industry expansion and operations well in line with consumer requirements. Even the U. S. Bureau of Mines was under fire from government and consumer groups when near-shortages of oil existed. It was charged that oil supply was artificially held down, when the fact was that expansion of facilities was needed and under way. Now potential supply exceeds demand, and there are charges of artificial curbing of supply for price reasons, while the fact is that surplus and wasteful production must be avoided to keep the industry healthy and able to continue meeting consumers' needs.

In spite of the critics, estimates of petroleum supply and demand continue to be essential, and they benefit the nation as well as the industry insofar as they help to keep industry operations on a sound and stable basis.

Independents Demand Limits on Imports

FACING THE prospect of a surplus of foreign oil from now on, independent producers of the U. S. have become increasingly insistent that limitations be placed on imports, to assure a healthy domestic industry and ample oil for emergencies. Leading the fight against imports is the strong Independent Petroleum Association of America, which now urges government action. Leaders of the organization feel that imports can be held down only by effective tariffs or import quotas. They foresee that within a few years areas outside the U. S. will have potential production 1 million barrels a day in excess of consumption outside this country. This surplus production naturally will seek markets in the U. S., they say, unless kept out by law.

Supporting the view that a world surplus of oil is to be expected were statements made at the IPAA mid-year meeting at New Orleans in early May by Wallace Pratt, eminent geologist and formerly a director of Standard Oil Company (N. J.), now retired. Pratt said that for many years the world will have available more oil than it can produce and use. He mentioned the large proved and potential reserves of the Middle East, Venezuela, and Canada and said that potential oil lands are well distributed over the earth, needing only to be developed to add to the supply. He added that the U. S. cannot do all the cutting back of production that oversupplies may require.

Heavy and Sour Crudes Problems for Refiners

THE INDUSTRY now is confronted with the need for important and costly refinery construction for solving new problems, after having completed much expansion that met the immediate postwar need for increased refining capacity.

The urgent new problem confronting refiners is that of making new installations that will better handle available crudes and turn out products that are wanted in the volumes in which they are required. Markets for heavy and sour crudes would be enlarged by new refinery facilities for handling them, and producers should be encouraged by the fact that refiners are taking steps toward installing necessary equipment.

An especially urgent need is for facilities that will produce less residual fuel oil and more gasoline, diesel oil, and other lighter products. This need has been emphasized by the sharp drop in residual and heavy crude prices, in reflection of lagging demand and oversupply. An important cause is the switching of railroads from oil-burning steam locomotives to diesels. This problem is especially acute in California, where residual fuel oil and heavy crude are in over-supply, despite cuts in prices and the shutting in of about 25,000 barrels a day of heavy crude production. Several major companies have undertaken to relieve the situation by enlarging their programs of expanding catalytic cracking facilities so as to get larger yields of light products and lower yields of residual. However, these facilities are costly and time-consuming in construction, and will require several years for completion.

Construction work of recent years has put emphasis on greater yields of lighter products, but this emphasis will have to continue, as evidenced by the present over-supply of residual and heavy crude.

Even the newer and large refineries face the problem of producing more premium gasoline of higher octane rating than heretofore, as automobiles are being designed for the improved fuels.

Another important problem is that of installing more equipment for processing sour crudes. This problem has been emphasized by the fact that West Texas sour crude is seeking additional markets, while more sour crude fields are being discovered in West Texas and many others are expected to be found.

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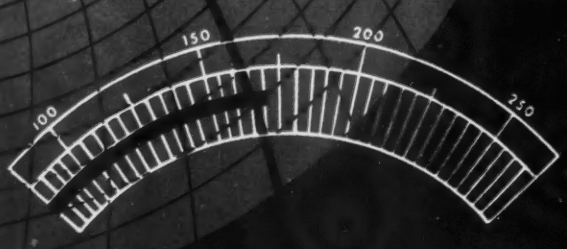

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CRUDE PRICE REDUCTIONS SPREAD . . . OIL INDUSTRY EXPANSION PROGRAM SLOWS TIDELANDS DEVELOPMENT IS RETARDED . . . STOCKPILING FOR PENN GRADE ASKED

Reduction of Crude Prices Spreads as Fuels Cut More

One of the most significant of the many crude and product price revisions of recent weeks was the general reduction of Michigan crudes by 22 cents a barrel in mid-May, initiated by Simrall division of Roosevelt Oil & Refining Company, the state's largest purchaser, and promptly followed by numerous other refiners. Michigan crude prices traditionally have gone up or down along with Mid-Continent postings. This cut created considerable fear that a Mid-Continent reduction was impending. Failure of the Michigan sweet crude cut to spread to other areas demonstrated the strength of the sweet oil market. Similarly significant was a 25-cent cut in sweet crude in the Wesson pool of Arkansas by Berry Asphalt Company, buying 1650 barrels daily from 16 wells.

Lowering of heavy crude prices has occurred in numerous fields all over the country. Standard Oil Company of California and Union Oil Company of California around and after the middle of May reduced prices by 25 cents for several California fields. In several heavy crude fields of Oklahoma, Rock Island Oil & Refining Company on May 23 cut postings 2 to 79 cents a barrel, increasing differentials for lower grades. The company said its refinery had been shut down for 30 days because low fuel oil prices made former crude postings prohibitive.

In the Oregon Basin field of Wyoming, The Ohio Oil Company was followed by The Texas Company in posting a flat price of $1.65 per barrel in place of the former gravity scale postings under which average takings of 21 gravity were priced at $2.09, a cut of about 44 cents a barrel. Several other Wyoming fields received similar reductions. Stanolind Oil Purchasing Company previously cut crudes under 36 gravity in 13 Wyoming fields by as much as 69 cents a barrel and an average of about 23 cents, sharply cutting heaviest grades.

Other heavy crude price cuts of recent weeks included the 25-cent reductions for several East Texas fields by major purchasers and similar cuts in six Arkansas heavy crude fields and four Mississippi fields, while the Baxterville field of Mississippi, yielding 16 gravity oil, had a 50-cent cut. Corning grade crude of Ohio was reduced May 6 by 40 cents a barrel.

New Mexico Asphalt & Refining Company May 20 reduced its posting for Eddy County, New Mexico, 36 gravity sour crude by 25 cents a barrel, new price being $2.19 a barrel, because of low fuel oil prices. It buys about 4,000 barrels daily.

Various skimming plants in Oklahoma and Texas have been closed down within the past few months because of low prices of fuel oils.

In reflection of lagging demand for lubricating oils, especially for export, Pennsylvania grade crude was reduced May 11 for the seventh time since early last December. A new 13-cent cut brought Bradford-Allegany crude down to $3.27 a barrel. It was $5.00 a barrel five months previously.

Further lowering of prices of heavy and light fuel oils has occurred in recent weeks. Effective May 21, Esso Standard Oil Company reduced No. 6 Bunker "C" fuel oil 15 cents a barrel in barges on the Atlantic coast and 5 cents a barrel on the Gulf Coast. At the same time the company reduced its tank car and barge prices of kerosine one-half cent a gallon on the Atlantic coast south of Baltimore and on the Gulf. These cuts brought Bunker "C" down to $1.20 a barrel and kerosine down to 7½ cents a gallon on the Gulf and put No. 6 fuel at New York down to $1.60 a barrel. No. 4 and No. 5 fuels were also lowered.

Effective May 9, Standard Oil Company (Ohio) made a reduction of one-half cent a gallon in tank wagon and tank car prices of No. 1 and No. 3 heating oils, kerosine, and diesel fuel through out Ohio. That was the fourth reduction on heating oils by the company since December.

Wholesale prices of gasoline have remained generally stable, with supply fairly balanced with demand and stocks in seasonal decline, although there has been some retail price cutting in various cities, including Chicago. Increases in wholesale gasoline prices in April in the East Coast region have been defended by major companies as necessary for several reasons. They cited higher refining costs, especially because of increased high octane gasoline output, and said gasoline must bear its proper share of refining costs and be priced high enough to assure continuing adequate supply to meet consumer demand.

Refineries Show Losses As Product Prices Drop

Following the drastic reductions in fuel oil prices in recent months, refining has been put on a break-even or loss basis, and independent refiners declare that there must be an improvement in product prices or a general reduction in crude prices if they are to stay in business. A major company executive has expressed a similar view of the refiner's position.

Western Petroleum Refiners Association made a survey of product yields, operating costs, and realizations in March for refineries in Kansas, Oklahoma, and North Texas with capacities of 4,000 to 8,000 barrels per day of skimming and thermal cracking. From the survey the conclusion was reached that the refiner who buys most of his crude "cannot continue to operate unless refined product prices improve above present levels so as to permit him to at least break even." Plants making asphalt and naphthas were found to be showing a loss of 5½ cents a barrel and plants not making those products showed loss of almost 17 cents a barrel. Total realization from products failed to cover cost of crude and manufacturing cost per barrel by those amounts.

B. Brewster Jennings, president of Socony-Vacuum Oil Company, commented on the refiner's unsatisfactory position in replying to North Carolina's Governor W. Kerr Scott, who asked for an explanation of April increases in gasoline prices.

"Even after the increase in the price of gasoline," said Jennings, "the most efficient refineries east of the Rockies probably can do no better than break even, while many may even operate at a loss." He stated that total effect of increase in gasoline prices and reductions in prices of most other petroleum products has been a reduction of 27 cents per barrel in Socony-Vacuum's realization from crude oil processed.

Oil Industry Earnings Show Decrease in First Quarter

Earnings of oil companies in the first quarter of 1949 were in the aggregate around 14 percent lower than in the like period of 1948, mainly because of lower prices of fuel oils. For this year as a hole, likewise, the industry is expected to have lower earnings than in 1948, due to lower price levels.

U. S. industry as a whole showed about 10 percent more profit in the initial quarter of 1949 than in the similar period of 1948. But results varied by industries and companies, nearly as many showing decreases as there were registering increases.

Oil company earnings continue to be affected adversely by the industry's price situation, which has shown further weakening in the second quarter, with crude oil now affected as well as products.

There is one consolation, however, in the earnings situation. It is the fact that the industry will be better able to operate with lower earnings because it will have somewhat lower requirements of funds for capital expenditures.

Expansion in Oil Industry Is Tapering Off in 1949

Following the record-high capital expenditures in 1948, oil companies generally will make smaller capital investments in 1949, although some have programs for investing increased amounts.

This tapering off reflects the fact that many companies have completed, or will complete this year, large expansion programs. The increased facilities apparently are regarded as fairly well in line with prospective demands, especially in view of the slowing down in growth of petroleum consumption. In 1947-1948 the industry spent about $5.8 billion for rehabilitation and expansion of facilities, and over $3 billion of this was spent in 1948.

In their annual reports, some companies cited heavy capital expenditures in 1948 but stated that they would spend less in 1949. Shell Union Oil Corporation said some of its important projects would be completed by the middle of 1949 and that the year's expenditures would be less than in 1948. Standard Oil Company of California also said it was completing major expansion this year. Standard Oil Company of Indiana said it would spend much less but at a fairly high level. Socony-Vacuum Oil Company made capital expenditures of $194 million in 1948 but expects to spend $175 million in 1949. Phillips Petroleum Company spent $139 million in 1948 but has a program of $110 million for this year. Gulf Oil Corporation indicated it would spend less in 1949 than in 1948. Capital expenditures will be about the same in 1949 as in 1948 for Atlantic Refining Company and Continental Oil Company.

On the other hand, Humble Oil & Refining Company had capital expenditures of $138 million in 1948 but will spend $155 million in 1949, while The Texas Company plans to increase expenditures from $235 million in 1948 to $275 million in 1949.

Another factor causing lower capital expenditures is the prospect of lower earnings this year because of the declines in prices of some petroleum products and crude oil.

Top of 5,400,000 Barrels Likely for Crude Output

Although the total demand for petroleum, domestic and export, was about 2 percent less in the first four months of 1949 than in the like months of 1948, forecasters estimate that for the year as a whole there will be an increase. The Independent Petroleum Association of America foresees an increase of 4 percent, with domestic demand up 4.5 percent and exports down 5 percent.

The IPAA estimate was released at the association's mid-year meeting in New Orleans May 3. It allowed for increases in domestic demand as follows: 5.5 percent for gasoline, 8 percent for kerosine, 8.5 percent for distillate, no change for residual, and a gain of 3 percent for all other oils.

Slowing down in rate of growth in oil demand in early 1949 was attributed by IPAA to: (1) Abnormally warm weather which reduced requirements for heating fuels; (2) A change in general business conditions reflected in a decrease in industrial activity, a decrease in wholesale price levels, and increasing unemployment; and (3) Large increases in foreign oil supplies available for consumption in the world market.

For the summer period April 1 to September 30 this year, IPAA expects total petroleum demand to average 6,210,000 barrels per day, an increase of 4 percent over actual consumption in the corresponding months last year.

Total stocks of crude petroleum and refined products on March 31, 1949, were 120 million barrels higher than one year previously, said the report, and stocks are substantially in excess of adequate working levels. It allowed for seasonal additions to stocks of 110,000 barrels daily in the second quarter and 180,000 daily in the third quarter, but suggested reduction of 380,000 daily in fourth quarter to put total stocks at end of 1949 at same level as at end of 1948. These stock changes would put required total new supply at 6,330,000 barrels daily in second quarter, 6,380,000 daily in third quarter, and 6,450,000 daily in fourth quarter, when total demand for petroleum is expected to average 6,830,000 barrels per. day.

To supply indicated demand, IPAA figured natural gas liquids production at 450,000 barrels daily in second quarter and 460,000 daily in third and fourth quarters. These figures indicated that requirements to be supplied from domestic crude production and imports of crude and products would average 5,880,000 barrels daily in the second quarter, 5,920,000 daily in third quarter, and 5,990,000 daily in fourth quarter. Demanding sharply lower imports, the IPAA report allowed for imports of only 130,000 barrels daily in second and third quarters and 160,000 daily in fourth quarter on the basis of merely supplementing domestic availability. On that basis, domestic crude production would be required at rates of 5,750,000 barrels daily in second quarter, 5,790,000 daily in third quarter, and 5,830,000 daily in fourth quarter.

However, imports of crude alone have been materially above IPAA's allowances for total imports. Crude imports have run as follows: 488,000 daily in January, 442,000 daily in February, 396,000 in March, 366,000 daily in April, and are estimated at about 350,000 daily in May and 325,000 daily in June. Imports of petroleum products probably have been running in excess of 150,000 barrels daily. In the second quarter, therefore, total imports probably will average close to 500,000 barrels daily. For the third and fourth quarters imports may be further curtailed, but a sharp reduction would be involved if they should be brought as low as 400,- indicated requirements for domestic production as figured by IPAA would be around 5,400,000 barrels daily in the third and fourth quarters. If the estimates of demand are too high, the domestic crude production might have to be held below 5,400,000 barrels daily.

Gulf Tidelands Development Is Affected Unfavorably

Development of oil on the Gulf Coast continental shelf now is doubly retarded by (1) litigation between federal and state governments over title, and (2) instability of the crude oil market.

The question of federal vs. state claims to title to submerged lands makes operations a great risk to the oil companies doing work in the Gulf, Morgan J. Davis, director in charge of exploration for Humble Oil & Refining Company, told the Texas Group of Investment Bankers Association of America in Houston. He also pointed out that costs of the offshore operations are tremendous and that they involve difficulties much greater than those in ordinary development.

Several oil company representatives have stated that the costly off-shore de-

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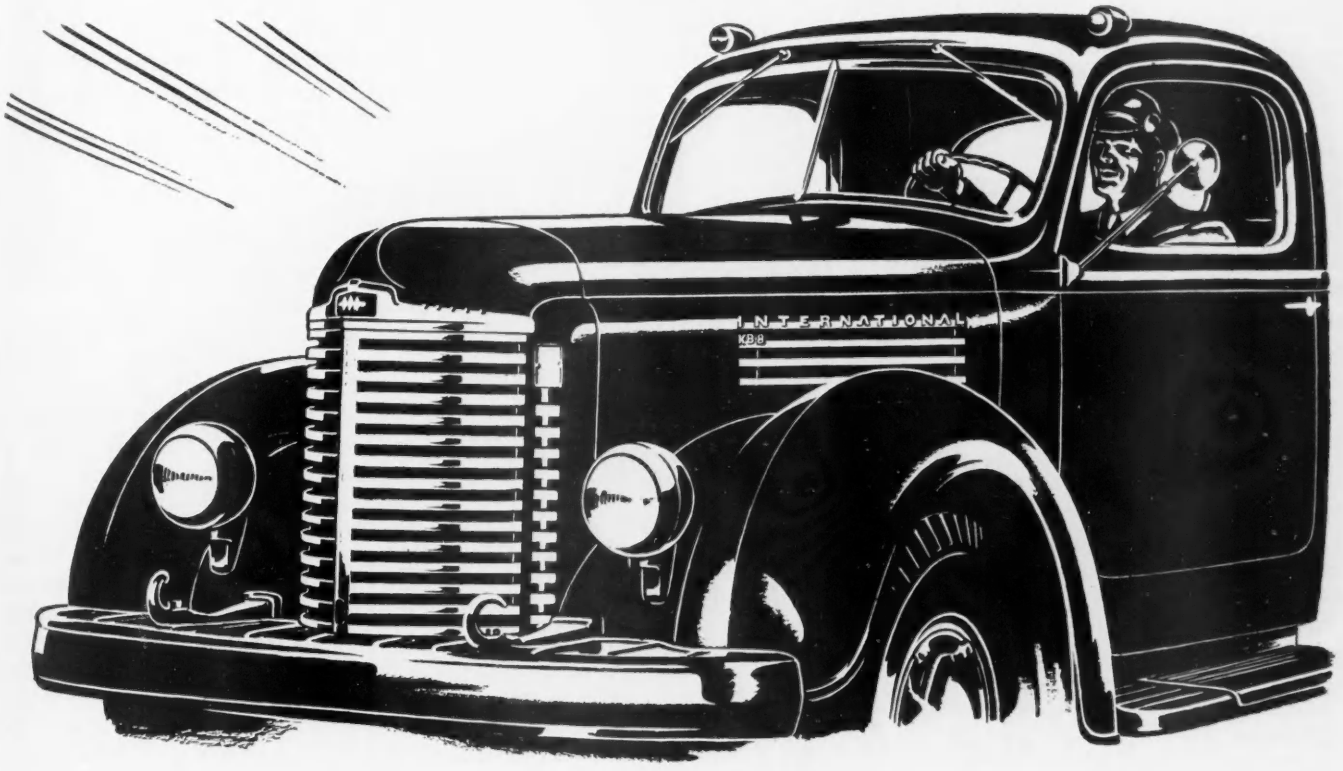

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velopment would not be profitable if crude prices were under 1948 levels.

According to Davis, 35 oil companies have spent $38 million in lease rentals and bonuses in acquiring 2,500,000 acres of land in the Gulf from Texas and Louisiana for oil development. This has resulted, he said, in six discoveries of oil and five gas discoveries through completion of 44 wells; while 25 wells are drilling or preparing to drill.

At the annual stockholders' meeting of Humble Oil & Refining Company, a leading offshore operator of the Gulf Coast, Hines H. Baker, president, said Humble has spent $6 million for Texas and Louisiana offshore leases and has invested $19 million in marine equipment, drilling platforms, and related facilities, and in drilling wells off the coast. The company completed 2 oil discovery wells in 1948, added 2 more in 1949, has 1 gas well, and is operating 7 drilling rigs on offshore leases. Baker expressed hope that Congress would pass legislation to solve the federal vs. state controversy over title to the continental shelf at an early date, so that development may be carried forth promptly on a basis which assures protection of property rights.

In accordance with the recent ruling of the U. S. Supreme Court, Texas and Louisiana will have to appear before that tribunal to contest the claims of the federal government to the lands off their coasts. The court is expected to hear the cases in its term that begins in October.

Meanwhile, Congress is making very little progress toward passing tidelands legislation of any kind.

Texas Legislature Enacts Bill to Permit Unitization

Unitization as a means for promoting efficient development of oil and gas reserves has been strengthened by enactment of a bill in the Texas legislature, specifically permitting cooperative or unit development under voluntary agreements. It grants a "reasonable" exception to the anti-trust laws for such agreements. The agreements must be submitted to the Railroad Commission for public hearing, and the commission must certify that the agreements will result in conservation of oil or gas.

Twelve other oil producing states have permissive statutes for unit development of private lands, and several more authorize unitization of public lands.

Benefits of unit development are especially evident in cycling, pressure maintenance, and secondary recovery operations.

The Texas bill as enacted was a compromise between the view that it should apply only to conservation and secondary recovery operations and the view that unit development could be made compulsory.

Increased Storage, Selling Required for LPG Industry

The liquefied petroleum gas industry, now needing increased markets to absorb available supplies, must do two important things, members of the Natural Gasoline Association recently were told. The industry must (1) Do a vigorous selling job to take advantage of a large potential market, and (2) Solve the problem of sufficient storage to avoid winter shortages.

Howard E. Felt, vice president of Warren Petroleum Corporation, said that while present gross sales of the industry are about $\$1\frac{1}{2}$ billion per year, there is an unsold market of $5 billion a year. He advised a national advertising program to show advantages of such products as butane and propane for domestic and commercial heating.

Like other suppliers of fuel, he said, the LPG industry will have to solve the problem of providing enough storage to meet the seasonally high demand of winter. The industry has been criticized and has lost markets because of local shortages of butane and propane during the past two winters in areas depending largely or wholly on these fuels.

Pennsylvania Grade Lube Stockpiling is Sought

The present surplus of Pennsylvania grade crude and lubricating oil reflects loss of domestic and foreign market outlets through disruptions caused by the war, according to the Pennsylvania Grade Crude Oil Association. The association has submitted a brief to the Armed Services Petroleum Board proposing that the government stockpile lubricating oils. The brief points out that prices of these oils are now down sharply, affording savings, and says purchases would provide a ready supply for emergency, at the same time relieving present unstable market conditions and preventing premature abondonment of well.

Two-thirds of Pennsylvania grade production now comes from secondary recovery operations, the brief states, and interruption of water flooding sacrifices oil recovery.

Pennsylvania grade lubricants supplied 15.8 percent of U. S. needs for the war (24 million barrels), said the brief, and in order to supply Armed services and essential needs, the industry had to sacrifice much of its domestic trade and outlets. It added that over 15 percent of lube output of the area normally was exported in prewar days, while export demand now is a "trickle," because of foreign buying policies. Consequently, the industry now is confronted with a critical over-availability of lubricating oils and insufficient markets. Given a reasonable market structure, the report said, the industry can recover 800 million barrels more of Pennsylvania grade crude by present known methods.

Since early last December, Pennsylvania grade crude prices have been cut seven times. From a post-war peak of $5 a barrel, Bradford-Allegany crude had dropped May 11 to $3.27 a barrel. However, production has been curtailed, and prices are not expected to decline much, if any, further.

Krug Urges Synthetic Fuels Plants for National Safety

Renewed pressure has been put on the petroleum industry by Secretary of the Interior Krug for the development of commercial-scale synthetic fuels plants. At the same time a new administration program to achieve that goal has been submitted to Congress by Senator McCarran (Dem., Nev.), who asks $650 million as a loan from the Reconstruction Finance Corporation to private industry to further the synthetics program.

Krug, speaking in Louisiana, Mo., at the dedication of the nation's first coal-to-oil demonstration plants, said the synthetics fuel industry needs to be developed on a commercial basis "so we shall be able to use it in any emergency threatening the existence of the nation." He said the program "is not government competition; we want private industry to do the job."

The McCarran bill nearly doubles the appropriation sought for synthetics work over the budget asked at the last session of Congress. It also gives the Interior Department a wider direction in the location of plants, raw materials and basic processes. And it still authorizes the government to build such plants "if private industry is unwilling or unable to take advantage of the loans offered."

Industry reaction to Krug's demands was cautious—many petroleum economists questioned the value of such a gigantic program at this time. Others questioned Krug's figures that a plant capable of producing 10,000 barrels a day of finished products might cost as much as $90 million to construct.

Krug referred to the "great potential reserve" of oil in shale in the Rocky Mountain area, where he said recoverable oil might be as much as 200 billion barrels.

One of the two Missouri plants is a hydrogenation unit which converts coal to oil by forcing hydrogen catalytically into pulverized coal under high pressure and heat. The other is a gas synthesis Fischer-Tropsch unit. The hydrogenation plant is expected to produce 300 to 400 gallons of fuel per day, and the gas synthesis plant, 80 to 90 barrels.

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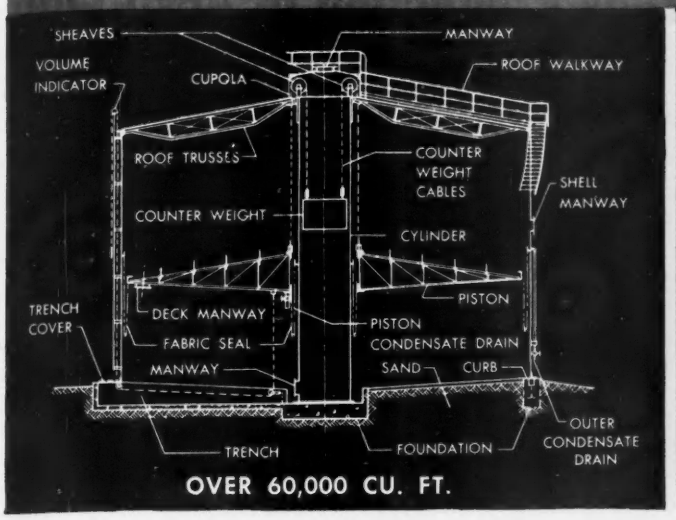

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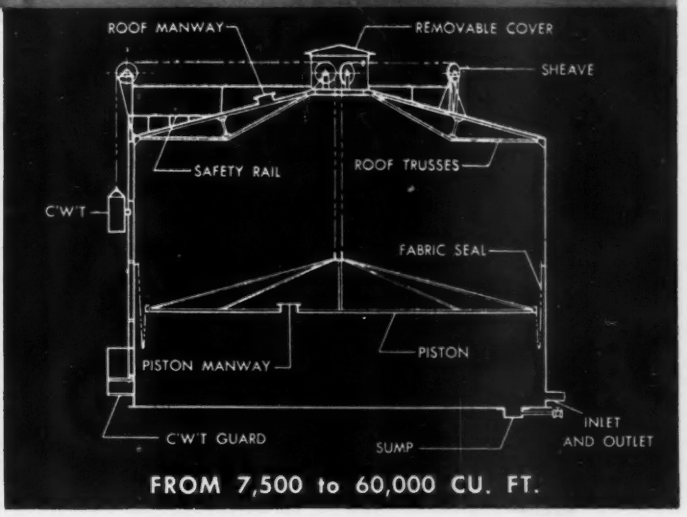

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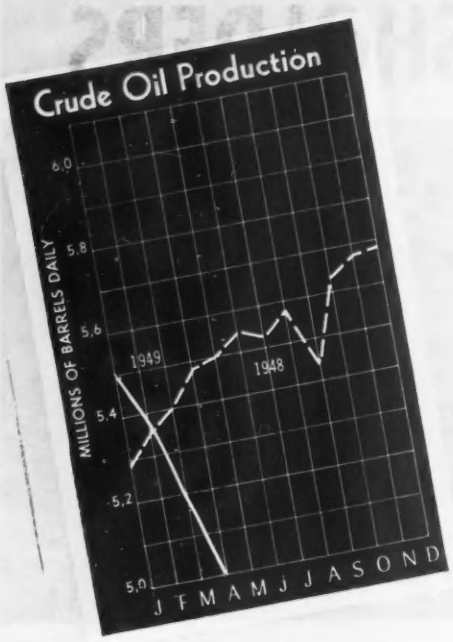
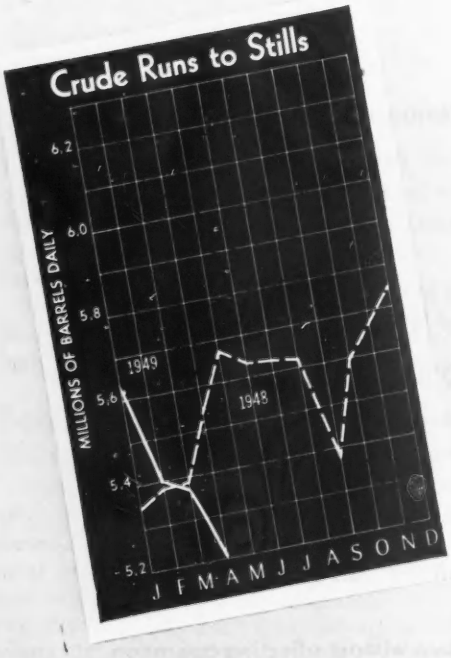
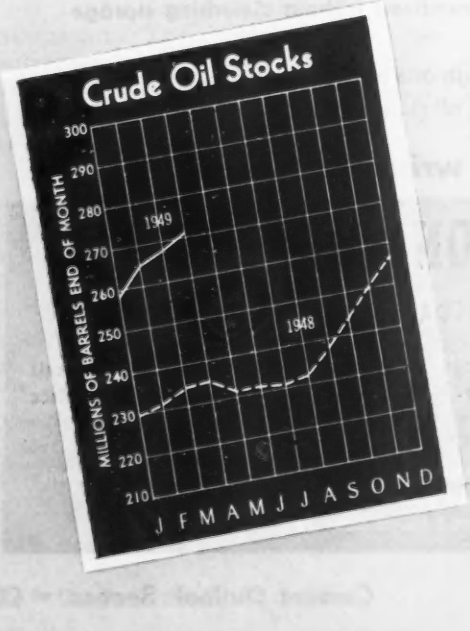
Crude Production in April Falls

By CECIL SMITH,







CRUDE production in April dropped below the 5 million barrels a day level for the first time in two years, and while daily crude runs to refinery stills remained above that level they were at an almost two-year low mark. The month saw the usual seasonal changeover in refined products demand as gasoline stocks began their annual downward trend and the light and heavy fuel oils started to accumulate.

Not since April, 1947, had U. S. daily crude production been less than 5 million barrels until output in April of this year averaged only 4,985,000 barrels. In dropping to this two-year low mark, production decreased 204,000 barrels per day from March's output and the entire loss occurred in Texas. Small gains and decreases occurred in other producing states, but these offset one another and it remained for the Texas fields to drop the nation's total. The Texas Railroad Commission by lowering allowable producing rates dropped the state's output to less than 2 million barrels a day for the first time since January, 1947. U. S. production in April amounted to practically ½ million barrels a day less than was produced during the same month a year ago.

U. S. refineries lowered their input to 5,175,000 barrels a day during April, and while these runs did not go below the 5-million-barrel level as

Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1946:									
January	4,625	4,520	227,996	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	231,827	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	225,928	1,900	104,161	815	29,922	1,213	32,995
April	4,673	4,663	227,013	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	226,505	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	228,064	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	229,319	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	229,223	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	227,818	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	227,660	2,117	85,952	788	76,780	1,090	55,580
November	4,823	4,684	231,788	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,789	230,176	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	229,432	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	230,911	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	234,980	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	241,663	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	243,593	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	242,707	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	236,182	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	233,843	2,383	85,849	869	54,707	1,245	51,334
September	5,251	5,236	230,452	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	231,941	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	231,085	2,332	87,551	942	61,334	1,245	52,455
December	5,337	5,350	230,654	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	229,842	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	231,419	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	234,164	2,252	111,949	1,050	32,124	1,307	41,945
April	5,484	5,540	234,506	2,396	109,289	978	34,514	1,303	43,301
May	5,502	5,668	231,318	2,486	108,552	992	40,781	1,314	48,518
June	5,544	5,632	231,412	2,529	104,518	998	48,352	1,280	52,465
July	5,522	5,631	230,955	2,494	98,839	994	58,725	1,264	58,431
August	5,577	5,621	231,954	2,532	95,445	1,038	68,818	1,248	64,096
September	5,435	5,376	237,302	2,416	90,518	961	76,320	1,154	68,005
October	5,632	5,594	243,972	2,490	92,426	1,069	82,920	1,268	72,363
November	5,675	5,672	250,066	2,551	95,589	1,081	83,909	1,277	77,033
December	5,688	5,720	256,254	2,626	103,697	1,106	*75,953 †71,381	1,299	*76,942 †63,993
1949:									
January	5,365	5,641	258,648	2,538	116,621	1,063	61,584	1,348	62,508
February	5,376	5,480	265,216	2,484	126,054	1,004	53,937	1,282	59,398
March	5,189	5,384	267,395	2,490	127,860	967	48,604	1,191	58,734
April	4,985	5,175	271,255	2,490	124,787	902	49,959	1,168	60,174
April, 1949:									
In Month	—204	—209	+3,860	....	—3,073	—65	+1,355	—23	+1,440
In One Year	—499	—365	+36,749	+94	+15,498	—76	.....	—135	.....
In Two Years	+11	+468	+29,592	+453	+23,063	+138	.....	+20	.....

* For comparison with prior months. † For comparison with subsequent months.

Trends

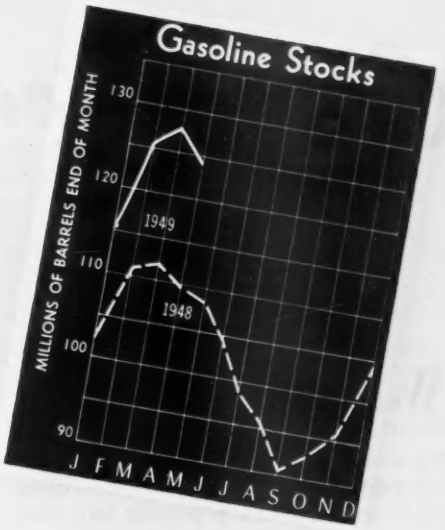
to Lowest Point in Two Years

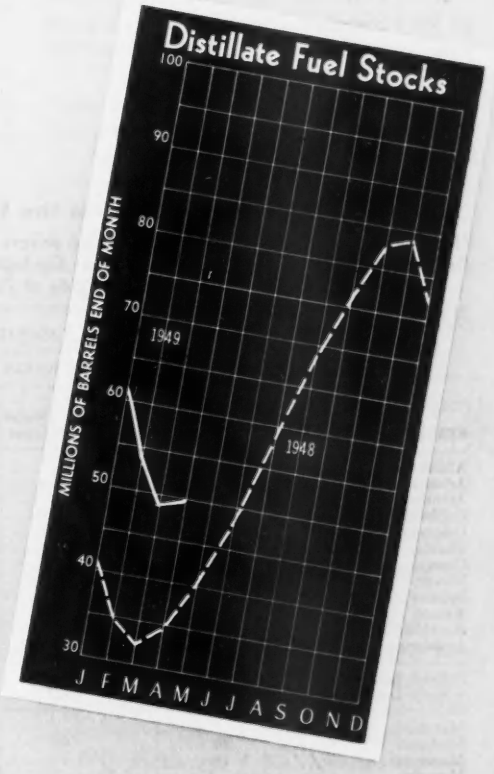
Staff Writer

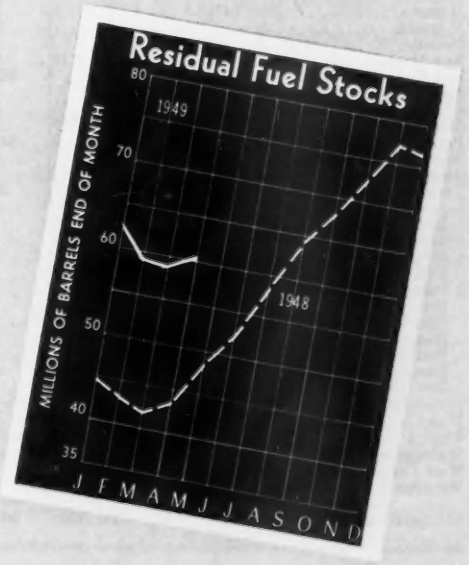
did crude production, they were at their lowest point since June, 1947. April's daily refinery runs were 209,000 barrels less than those of the preceding month and 365,000 less than they had been a year earlier.

Despite the refinery activity cutback, gasoline production remained unchanged from a month earlier. In each period output of this product averaged 2,490,000 barrels a day. However, this production could not meet the increasing demands for motor fuel brought by the month's warmer weather and as a result stocks of finished and unfinished gasoline were lowered 3,073,000 barrels. Gasoline inventories totaled 124,787,000 barrels at the end of the month, which were 15,498,000 barrels more than were on hand a year before. These stocks had totaled 127,860,000 barrels at the end of March which was the highest point ever reached, but April's increased agricultural and motoring needs started making withdrawals from storage necessary as is the case each year.

At the time gasoline stocks were starting downward, the light and heavy fuel oils began to stockpile. Although distillate fuel oil production was lowered 65,000 barrels a day during April, stocks of this fuel gained 1,355,000 barrels boosting the total to 49,959,000 barrels. A smaller cut of 23,000 barrels a day was made in residual fuel output, but a slightly larger gain of 1,440,000 barrels raised these stocks to 60,174,000 barrels by the end of the month.







Stocks of distillate and residual in 1949 do not include California cracking stocks, etc., which were included in 1948, and which on Dec. 31, 1948, amounted to 4,572,000 barrels of distillate and 12,949,000 barrels of residual.

State Crude Oil Production

(THOUSANDS OF BARRELS)

STATE OR DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST FOUR MONTHS		
	April, 1949	March, 1949	April, 1948	% Diff. Apr. '48-'49	1949	1948	% Diff. '48-'49
Alabama	1.2	1.2	1.1	+ 9.1	148	147	+ 0.7
Arkansas	86.4	86.1	85.9	+ 0.6	10,331	10,392	— 0.6
California	949.3	953.9	943.3	+ 0.6	113,718	113,373	+ 0.3
Colorado	66.6	63.6	45.2	+ 47.3	7,809	5,445	+ 43.4
Florida	1.5	1.3	0.7	+114.3	156	96	+ 62.5
Illinois	177.4	175.0	170.5	+ 4.0	20,752	20,808	— 0.7
Indiana	23.4	22.7	16.9	+ 38.5	2,694	1,794	+ 50.2
Kansas	292.1	292.9	306.0	— 4.5	34,730	34,906	— 0.5
Kentucky	23.3	23.0	21.4	+ 8.9	2,727	2,838	— 3.9
Louisiana	510.7	507.4	486.6	+ 5.0	61,863	57,862	+ 6.9
North Louisiana	121.3	130.7	118.5	+ 2.4	14,753	13,923	+ 6.0
South Louisiana	389.4	386.6	368.1	+ 5.8	47,110	43,939	+ 7.2
Michigan	44.0	42.9	45.1	— 2.4	5,381	5,460	— 1.4
Mississippi	109.8	108.3	121.7	— 9.8	13,261	14,327	— 7.4
Missouri	0.1	0.1	0.1	.....	16	18	— 11.1
Montana	23.9	24.2	24.9	— 4.0	2,884	2,936	— 1.8
Nebraska	0.3	0.3	0.8	— 62.5	57	75	— 24.0
New Mexico	130.6	134.6	130.7	— 0.1	15,953	15,499	+ 2.9
New York	13.9	13.9	12.9	+ 7.8	1,558	1,523	+ 2.3
Ohio	9.5	9.6	9.2	+ 3.3	1,105	1,041	+ 6.1
Oklahoma	407.5	398.6	419.3	— 2.8	49,893	48,910	+ 2.0
Pennsylvania	29.9	30.1	36.3	+ 17.6	3,729	4,186	— 10.9
Tennessee	.....	.....	.....	.....	2	2	.....
Texas	1,951.5	2,155.5	2,453.6	— 20.5	263,009	291,388	— 9.7
Dist. 1—South Central	25.4	26.9	25.8	— 1.6	3,215	3,100	+ 3.7
Dist. 2—Middle Gulf	124.8	142.2	172.2	+ 27.5	17,691	20,653	— 14.3
Dist. 3—Upper Gulf	382.7	424.2	493.2	— 22.4	51,978	59,870	+ 13.2
Dist. 4—Lower Gulf-SW.	189.6	207.6	253.4	— 25.2	25,454	30,762	— 17.3
Dist. 5—East Central	36.2	42.2	46.0	— 21.3	5,094	5,381	— 5.3
Dist. 6—Northeast	345.1	376.7	438.2	+ 21.3	46,678	52,470	— 11.0
Dist. 7-B—N. Central	58.7	60.9	44.5	+ 32.0	7,429	5,310	+ 39.9
Dist. 7-C—W. Central	42.8	47.0	44.4	— 3.6	5,641	5,303	+ 6.4
Dist. 8—West	539.6	614.3	678.6	— 20.5	74,695	80,717	— 7.5
Dist. 9—North	118.9	126.3	137.5	— 13.5	15,672	16,964	— 7.6
Dist. 10—Panhandle	87.7	87.3	84.2	+ 4.2	10,617	10,470	+ 1.4
Utah	0.3	0.2	.....	.....	23	.....	.....
Virginia	0.1	0.1	0.2	— 50.0	10	14	+ 28.6
West Virginia	7.5	7.2	7.7	— 2.6	871	873	— 0.2
Wyoming	123.7	136.7	143.5	— 13.8	15,315	17,104	— 10.5
Total United States	4,984.5	5,189.4	5,483.6	— 9.1	627,995	651,107	— 3.5

Completions

6 Percent Above 1948 Period

WELLS completed in April numbered slightly more than those drilled in the previous month or in the same month of last year. As a result, this year's drilling continued to hold a 6 percent lead over last year's record-breaking activity.

April's drilling accounted for a total of 3244 completed wells to show a small gain over March's 3230 and the 3186 finaled in April of last year.

At the end of four months, this year's completed wells totaled 12,015 for a gain of 5.9 percent from the 11,346 drilled in the same period of 1948. Last year's total of more than 39,000 wells was an all-time record and whether this year's program can continue to hold its present lead remains to be seen. Recent price cuts in heavy crude areas and in the Appalachian region along with possible threats of other reductions do not brighten the prospects of continuance of this high drilling rate.

While wells have been about six percent more numerous this year, the total footage represented in these holes show an even greater increase of 11.8 percent. New wells in 1949 have averaged 3673 feet each, or 185 feet deeper than the 3488-foot average for the 1948 period. This difference is due principally to slackened drilling in the shallow Appalachian region and the increases in the comparatively deeper areas of Texas, Louisiana, California, and Oklahoma.

Well Completions in the United States during April, 1949, and Cumulative for Year

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from The Producers Monthly)

STATE OR DISTRICT	MONTHLY COMPLETIONS, APRIL, 1949									TOTAL COMPLETIONS				CUMULATIVE TOTAL				Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	NEW WELLS																			
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	April 1949	Mar., 1949	April, 1948	Footage April, 1949	Wells 1949	Wells 1948	Percent Diff.	Footage 1949	April 30, 1949	March 31, 1949	April 30, 1948
Alabama				4				4		4	1	2	13,395	6	4	+ 50.0	33,359	3	5	3
Arizona											2			3			7,766	6	6	7
Arkansas	19	1		7				27		27	20	27	112,068	87	92	— 5.4	388,597	32	25	35
California	156		1	45				202	2	204	248	185	709,878	872	804	+ 8.5	3,332,133	256	267	276
Colorado	2			2				4		4	5	19	20,786	13	86	— 84.9	64,021	21	26	58
Florida				1				1		1	5	2	3,845	8	8		54,803	3	1	4
Georgia				1				1		1	1		3,845	3	2	+ 50.0	7,555	1	1	
Illinois	106			76				182		182	142	128	430,484	621	556	+ 11.7	1,569,902	257	190	242
Indiana	46		1	43	1			91		91	91	61	188,784	318	276	+ 15.2	616,520	134	129	100
Kansas	118		5	91			1	215		215	247	231	727,582	854	793	+ 7.7	2,865,553	312	263	284
Kentucky	19		23	20				62		62	74	51	116,054	276	212	+ 30.2	500,882	83	75	75
Louisiana	84	8	13	36				141		141	165	200	844,264	600	608	— 1.3	3,607,959	195	202	227
North Louisiana	41	4	12	19				76		76	73	124	282,574	290	375	— 22.7	1,002,361	52	60	76
South Louisiana	43	4	1	17				65		65	92	76	561,690	310	233	+ 33.0	2,605,598	143	142	151
Maryland															1	—100.0				
Michigan	28			48				76		76	73	44	176,318	295	193	+ 52.8	673,491	103	106	120
Mississippi	13	1		16				30		30	38	24	214,618	113	123	— 8.1	868,231	31	31	43
Missouri			2	1				3		3	1	9	1,569	5	21	— 76.2	2,518	6	6	7
Montana	15		1	6				22		22	18	14	66,656	66	88	— 25.0	192,739	38	46	49
Nebraska															1	—100.0		1	1	
Nevada																		1	1	
New Mexico	30	1	7	14				52	9	61	42	68	236,014	186	215	— 13.5	807,325	93	95	110
New York	54				36			90		90	150	130	126,140	473	554	— 14.6	573,387	121	146	171
North Dakota																		1	1	1
Ohio	25		29	25				79	4	83	81	109	183,992	346	380	— 8.9	813,220	141	152	225
Oklahoma	241	1	24	156				422	6	428	376	388	1,526,680	1,316	1,248	+ 5.4	4,895,188	482	484	581
Pennsylvania	67		26	9	61	10		173		173	159	263	296,734	807	1,030	— 21.7	1,407,779	291	327	369
South Dakota												1			1	—100.0		1	2	
Tennessee												4		6	14	— 57.1	6,058	9	7	20
Texas	730	32	31	419	2			1,214	19	1,233	1,202	1,117	5,404,452	4,369	3,654	+ 19.6	18,876,595	1,245	1,362	1,458
Dist. 1—S. Central	25			26				51	1	52	60	49	146,834	201	170	+ 18.2	577,853	44	41	49
Dist. 2—Middle Gulf	38	8	7	25				78	2	80	51	83	470,962	216	258	— 16.3	1,306,070	46	65	66
Dist. 3—Upper Gulf	59	9	4	40				112	1	113	110	103	766,478	436	318	+ 37.1	2,764,269	144	146	141
Dist. 4—L. Gulf-SW	56	14	6	44				120		120	164	124	627,819	510	430	+ 18.6	2,560,837	101	115	125
Dist. 5—E. Central	11	1	1	17				30		30	15	14	118,292	91	57	+ 59.6	419,311	17	29	32
Dist. 6—Northeast	48		4	12				64		64	111	30	283,741	303	128	+136.7	1,350,946	34	35	55
Dist. 7-B—N. Central	96		6	93				195	7	202	184	120	616,922	610	412	+ 48.1	1,881,022	164	198	165
Dist. 7-C—W. Central	32			17				49	1	50	33	30	226,406	111	121	— 8.3	516,459	51	53	78
Dist. 8—West	240		2	31				273	6	279	216	280	1,434,754	863	915	— 5.7	4,405,914	397	408	495
Dist. 9—North	125		1	114	2			242	1	243	241	213	712,244	789	666	+ 18.5	2,252,209	129	135	109
Dist. 10—Panhandle											17	71		239	179	+ 33.5	841,705	118	137	143
Utah	2							2		2	6	2	8,595	11	8	+ 37.5	53,984	16	14	9
Virginia															1	—100.0				
Washington												1			1	—100.0				1
West Virginia	3	1	24	7				35	2	37	35	69	120,917	154	251	— 38.6	444,805	284	302	390
Wyoming	43		3	27				73	1	74	48	37	370,299	207	121	+ 71.1	994,594	99	96	119
Total U.S.	1,801	45	190	1,054	100	10	1	3,201	43	3,244	3,230	3,186	11,903,969	12,015	11,346	+ 5.9	43,748,964	4,266	4,369	4,989

Industry's Steel Prospects Favorable

By HENRY OZANNE
Staff Writer

A DECIDEDLY improved prospect on the steel needs of the petroleum industry is reported by the National Petroleum Council's Committee on Petroleum Industry Steel Requirements, headed by Russell B. Brown, general counsel for the Independent Petroleum Association of America. Brown's 23 man committee in a final report reviewed its monumental report of March, 1948, and found a much more encouraging situation currently prevailing. The committee says:

"It is now estimated that the total steel requirements on an over-all basis will be approximately the same for 1949 as the amount actually received in 1948. This results from decreased needs, as compared with actual receipts during 1948, for domestic refining and domestic crude and product pipe lines, offset by increases over 1948 receipts for natural gasoline and pressure maintenance plants and for natural gas transmission lines. Domestic producing operations, domestic marketing plant facilities and total American-owned foreign operations are expected to require approximately the same amount of steel as actually received in 1948, although foreign producing operations will be somewhat lower than in 1948 with somewhat reduced steel needs."

Total of the 1949 requirements, revised on an over-all basis, are put at 22 percent less than was estimated by the committee in March, 1948.

The committee finds that the steel supply situation has improved steadily during the last 12 months. "Whereas the industry was hard-pressed to obtain sufficient steel materials in almost every phase of its operations during 1947 and most of 1948, it can now obtain them without serious delay in most cases."

Individual hardship cases should diminish, "and may be eliminated entirely in the reasonably near future," the committee predicts. Hence it recommends to the National Petroleum Council that there is now no need for additional voluntary agreements for the allocation of steel materials to the oil industry, "and the exportation of steel to American companies for their own use is an industry problem for which government export controls do not provide a proper solution."

REVISED ESTIMATES of industry's steel needs indicate total requirements in 1949 will be about the same as actually received in 1948. Supply has improved to the point where materials now can be obtained without serious delay in most cases, and individual hardship cases may be eliminated in the near future.

Less steel will be needed in 1949 than in 1948 for domestic refining and domestic crude and product pipe lines. But those decreases will be offset by increases in requirements for natural gasoline and pressure maintenance plants and natural gas pipe lines. Same tonnage in 1949 as in 1948 will suffice for domestic drilling, producing, and marketing facilities and total American-owned foreign operations.

Domestic Production Situation

In analyzing the domestic production situation, the committee notes that drilling operations are expected to continue at about the same level during 1949 as in 1948. "During 1949, about 134 million feet of new well footage should be drilled. At an expected average depth of 3525 feet, the new wells to be drilled in 1949 should number about 38,100, which is about 700 less than in 1948.

The domestic oil industry received delivery of 1,515,000 tons of oil country tubular goods during 1948 with which it drilled 134,700,000 feet of hole for an average expenditure of 11.2 tons of oil country tubular goods per 1000 feet of new hole drilled. U. S. Department of Commerce estimates indicate there may be as much as 1,700,000 tons of oil country tubular goods, after exports, available to the domestic industry for drilling during 1949. This amounts to 12.7 tons per 1000 feet of new drilling footage forecast for 1949.

The committee reports that barring steel strikes, there will be a further increase in pipe production to the extent that "the supply of conventionally manufactured oil country tubular goods available in 1949 will be sufficient to meet over-all anticipated requirements for oil country tubular goods. This apparently will not be true of line pipe, despite anticipated further substantial increased production, because of the heavy demands for the building of pipe lines."

The committee reports that the following natural gasoline and pressure-maintenance projects were in various stages of completion at the beginning of 1949: Arkansas 4, California 12, Iowa 1, Kansas 3, Louisiana 9, Mississippi 1, Wyoming 2, New Mexico 4, Oklahoma 12, Texas 99. Total U. S. 147.

Of this total, 24 plants had received substantially all of their steel requirements in 1948 for completion early in 1949. Fifty-two plants are sufficiently advanced to require the remainder of their steel in the first quarter of 1949; 30 plants will require steel in the second quarter; 25 in the third quarter, and 16 in the fourth quarter.

The pipe line situation has improved greatly in recent months, the committee finds. "Deliveries have been advanced at least a full quarter with the result that many lines are now being laid ahead of schedule. It appears that the requirements for delivery during 1949 will be

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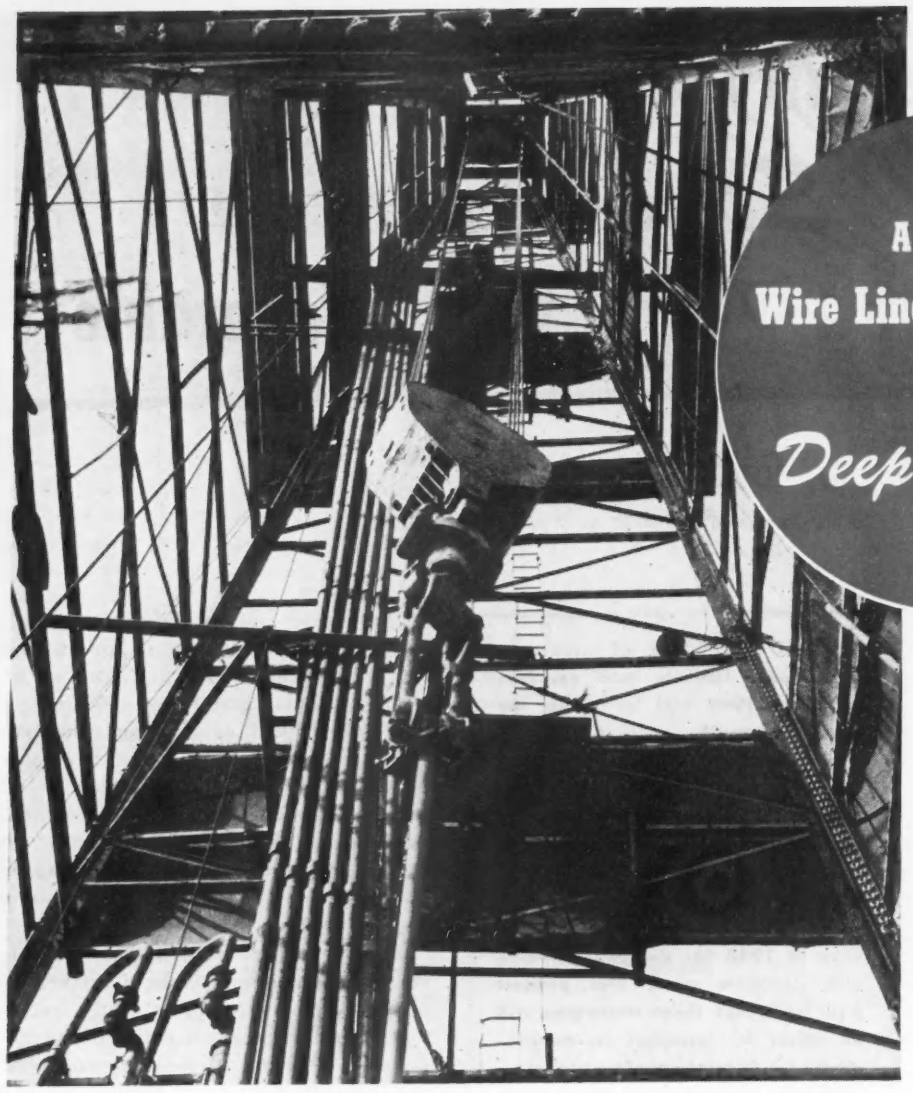


A Look at Wire Line and Hoisting for *Deep Drilling*

By J. E. KASTROP
Staff Writer

Perspective view of the hoisting system and derrick on the rig which drilled the Weller 51-11, 1947 champion depth breaker, with a total depth of 17,823 feet. The last few stands of drill pipe are being run in the hole near the 17,000-foot mark.

EXTREMELY HEAVY loads, both dynamic and static, occasioned by 20,000-foot drilling pose some difficult problems. Wire rope engineers, metallurgists and hoisting equipment designers have concentrated on this problem for a number of years, and they have come up with some interesting answers.

COLONEL DRAKE had little difficulty in selecting hoisting equipment for his rig when he drilled the Titusville well that put the American oil industry in business. Neither he nor others for the following 75 years had to worry too much about hoisting problems. This is indeed a tribute to the equipment manufacturers.

The situation today, however, has been completely reversed. Until a few years ago, manufacturers of oil field equipment, including wire rope makers, held a steady pace which was far ahead of oil industry requirements for drilling machinery. For more than a year now, the need for stronger drilling materials has surpassed the capacities of equipment.

The problem is not solved by merely making a bigger and thus stronger wire rope. Manufacturers have succeeded in this accomplishment long ago. In deep mines and on large suspension bridges wire rope is to be found that will carry more weight than deep drilling could possibly impose.

The oil business has available some excellent equipment that has resulted in many unusual and outstanding achievements. However, drilling has reached such depths that such heavy demands are placed on wire rope and the entire hoisting system as to make the problem critical. The punishment given wire rope in deep drilling is not paralleled by machinery in any other industry. The constant bending and reverse bending of ropes under heavy loads requires that the metal be both ductile and of high tensile strength. Therefore, a compromise must be made between these two characteristics to provide a satisfactory wire rope for oil well drilling. Utilizing their experience and metallurgical knowledge, manufacturers have had to increase wire rope sizes in order to satisfy the increased loads and at the same time provide adequate ductility in the metal to withstand the constant flexing.

Until a few years ago, 1¼-inch wire rope had ample strength and ductility to handle loads in the deepest wells. But with drilling depths exceeding 18,000 feet, loads imposed on the hoisting system have been multiplied greatly. In the past, rig designers have met this problem of increasing loads by building bigger and heavier rigs. Today, however, many feel that the saturation points on rig weight and bulk have just about been reached. It is not too difficult to make larger crown blocks, traveling blocks and stronger derricks to accommodate heavier loads and larger wire rope sizes, but drawworks design faces weight and space limitations. Thus, one of the big problems lies in the design and construction of a practical drawworks that will properly handle these larger sizes of wire rope. One and

three-fourths inch wire rope is available, but there is not a drawworks made today that will adequately handle such a large size. It is noteworthy that a large number of the so-called "big" rigs use 1⅜-inch wire rope. Extra-heavy rigs designed and built in the past year include provisions for employing wire rope up to 1½ inches. A few rigs in operation today use the larger 1½-inch rope.

A brief analysis of the hoisting problem for deep drilling is challenging. Loads that must be supported by the hoisting system are essentially of two kinds: the drill string, made up of the bit, drill collars, drill pipe, tool joints, kelly, swivel elevators, bails and hook, and casing strings that must be cemented in the hole if production is to be expected from these great depths. If calculations do not include the buoyant effect of fluid in the hole (and many do not, utilizing this factor as an additional margin of safety), the weight of a complete string of 4½-inch, 20.0-pound drill pipe 20,000 feet long is about 440,000 pounds. A similar string of 3½-inch drill pipe will weigh 355,000 pounds.

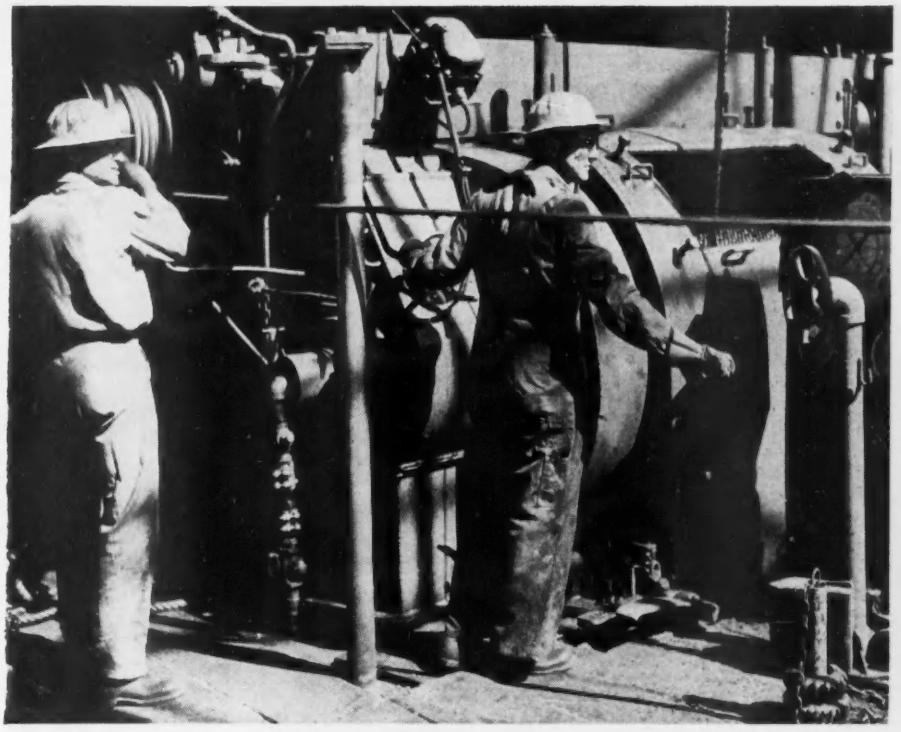
It is true that this tremendous load increase can be handled with 1⅜- or 1¼-inch wire rope by increasing the number of lines in the hoisting system. But in doing so, life of the line is decreased due to the additional reverse flexures, more layers would have to be wound on the drawworks drum, and the time required to make a round trip in changing bits and performing other operations would be almost prohibitive.

Since time represents money, big savings can be effected by minimizing round trip time. Studies of deep wells drilled in 1947-48 indicate that total round trip time below 10,000 feet usually exceeds total drilling time below that depth. If this ratio of round trip time to drilling time remains constant for deep wells (actually, with ten lines in the block, round trip time to drilling time will be even greater), it can be expected that almost one-half the time spent in drilling a 20,000-foot well will be consumed in making round trips.

In drilling medium-depth wells (6000-8000 feet) with 4½-inch drill pipe, six lines of 1⅛-inch wire rope are permissible, but eight lines are preferable. As the depth increases and the loads become larger, more lines must be strung

TABLE 1

Casing Size Inches Outside Diameter	Setting Depth Feet	Total Weight of String—Pounds
9⅝	15,000	720,000
8⅝	20,000	756,000
7	20,000	650,000
6⅝	20,000	565,000
5½	20,000	375,000
5	20,000	325,000



Business end of the hoisting system on drilling rigs is the drawworks. This model was used to drill Superior's 1947 record-depth well.

in the hoisting system, and even larger lines must replace the smaller ones used in the shallow drilling. At 10,000 feet, eight lines of 1¼-inch wire rope are required. In a 20,000-foot well, the last 3000 feet will require ten lines of the 1½-inch wire rope to remain within desired safety limits. To run casing at this depth, 12 lines of 1½-inch wire rope would have to be strung in the derrick.

Casing Weights

Running casing in a 20,000-foot well will impose the greatest static load on the hoisting system and derrick. Table 1 summarizes some casing weights for this depth well. These weights are based on SAE 4340 combination strings, high-strength joints and a minimum yield strength of 105,000 pounds per square inch.

Since casing is run to these depths only once per well, additional time can be taken for the operation as required by the 12-line system necessary.

A deep drilling study group composed of 29 engineers and manufacturers representatives sponsored by the Houston

TABLE 2

Limiting Hook Capacities (S.F. of 3.75) in Pounds

Rope Size	*Ultimate Strength	8 Lines	10 Lines	12 Lines
1¼-inch...	130,000	278,000	346,000	416,000
1⅜-inch...	156,000	333,000	416,000	500,000
1½-inch...	185,000	390,000	487,000	585,000
1⅝-inch...	216,000	450,000	562,000	675,000

* Ultimate strength in pounds for improved plow steel 6x19 hemp center wire rope. These figures do not reflect any increase in ultimate breaking strength due to internal wire rope cores.

Chapter of API produced some interesting figures concerning hoisting. Table 2 refers to limiting loads that can be imposed on the hook with various lines strung in the derrick and utilizing a safety factor of 3.75.

Commonly accepted safety factors in present engineering practice are five for actual drilling operations and about three for running casing. This larger safety factor for drilling is based on static loads but is used to take care of the dynamic loads imposed on wire rope during round trips, etc. Due to present limitations in wire rope physical characteristics, these safety factors had to be altered to a less desirable and lower figure for extremely great depths. A compromise, not 100 percent satisfactory to the drilling engineers, of 3.75 was suggested for both drilling and casing operations in order that size and bulk of hoisting equipment could remain within the realm of reason.

These figures confirm the necessity of employing ten lines when drilling near the 20,000-foot mark with 1½-inch wire rope, as well as using 12 lines to run seven-inch or smaller casing. Utilizing these recommended safety factors, even the 1⅝-inch wire rope is not of sufficient strength to run 20,000 feet of 8⅝-inch SAE 4340 casing, though it is not likely that anyone will want to do so.

From a theoretical standpoint, size of wire rope has a marked effect on the design of the drawworks, and particularly the drum. Considering 1½-inch diameter wire rope, eight line reeving and a hook travel of 135 feet, it has been

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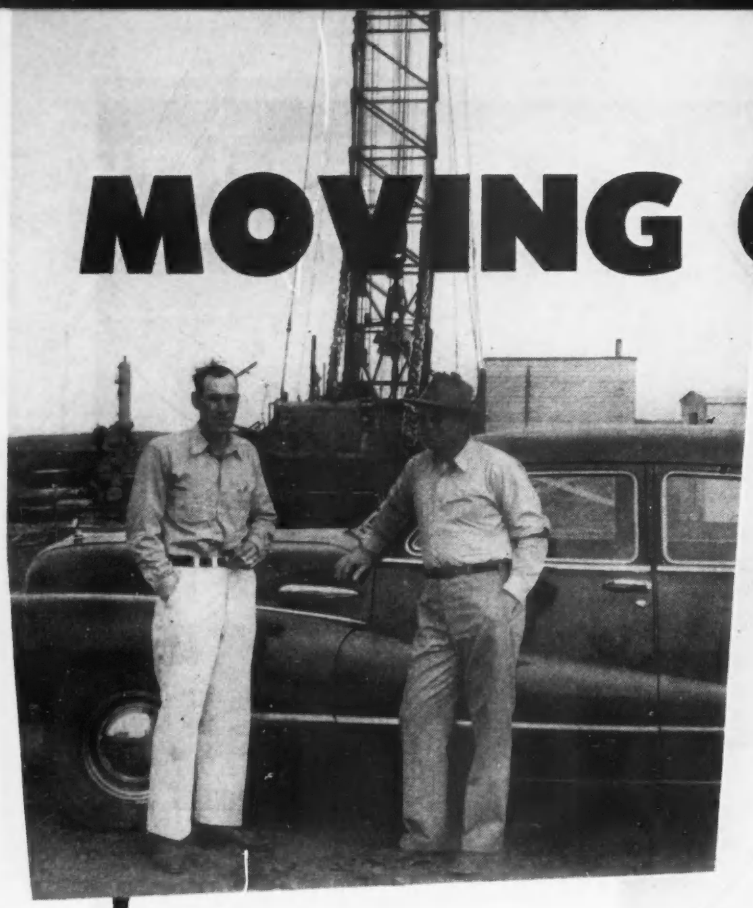

Harry Webster and Boyd McIntyre of McIntyre and Webster, Drilling Contractors at Edmonton, Alberta.

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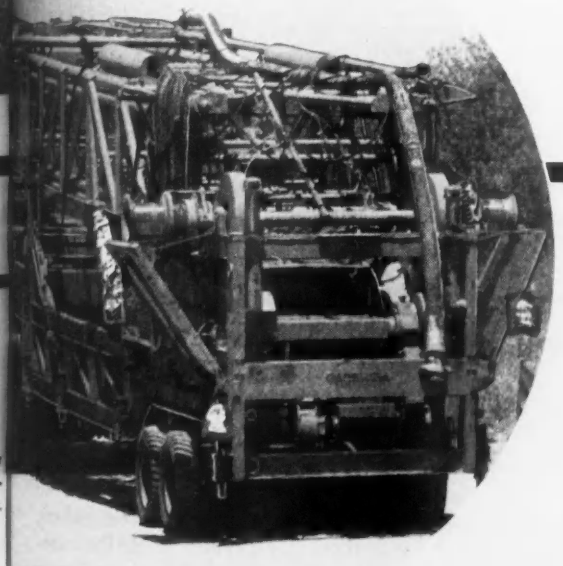

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shown that the optimum drum size for single layer spooling is 58 inches in diameter and 119 inches in width. From a practical point of view, such size is almost prohibitive, since the friction brake drums would have to be considerably increased. However, when the possibilities of regenerative braking of direct-current electric motor drives for drawworks are considered, it does not appear impossible that such dimensions can be incorporated into a drawworks.

Manufacturers of traveling blocks, crown blocks and of drawworks have considered the hoisting problem of 20,000-foot drilling and already have their answers prepared. They have apparently come to the conclusion that, for awhile at least, a 1½-inch diameter wire rope is the smallest size that will be available to handle the expected loads. One 20,000-foot rig already in operation incorporates hoisting equipment to accommodate 1½-inch wire rope and the heavy loads of this type drilling. There are two manufacturers now making crown blocks for this larger size rope as well as two companies making traveling blocks for 1½-inch diameter rope. Compared to these findings, there are four manufacturers now providing the industry with drawworks of sufficient capacity to handle loads requiring 1½-inch wire rope.

Manufacturer's Plans

A recent survey among 16 leading manufacturers of drilling rig hoisting equipment reveals that in addition to those now making equipment for 1½-inch wire rope, there are four who contemplate making or who are now designing crown blocks for 20,000-foot drilling and 1½-inch wire rope. Of this group, there are five who contemplate making traveling blocks to accommodate 1½-inch wire rope for deep drilling. Three manufacturers plan to make larger drawworks for 1½-inch wire line and 20,000-foot drilling.

There has always been a difference between the diameters of the drawworks drum and the pitch diameter of both the traveling and crown blocks for any given size of wire rope. When the specifications for equipment now available for 1½-inch wire line and 20,000-foot drilling are examined, it is found that the largest drawworks drum diameter is 42 inches (three large drawworks for 1½-inch wire rope have drum diameters of 36 inches and less). On the other hand, the pitch diameter of the largest crown block and traveling block for 1½-inch wire rope and 20,000-foot drilling is 60 inches. Undoubtedly, this large difference has resulted from a compromise in weight and dimensions in drawworks design commensurate with size limitations. If it is assumed that the crown and traveling block sheaves are ideally designed for the larger size wire rope, then it must be concluded that there remains much work to be done in the design of drawworks drums, since it is on the latter that the crushing and bending of wire rope is to be expected in multi-layer winding. Grooving drums for 1½-inch wire rope will undoubtedly reduce to a large extent this type of damage to the wire rope. While it is recognized that a compromise is necessary in the practical design of drawworks drums for 20,000-foot drilling, it must also be recognized that this compromise is at the expense of a decrease in the expected life of wire rope. It must be pointed out that wire rope manufacturers are spending large sums of money in the search for better steels from which to make rotary wire rope for deep drilling. However, the outlook for the near future is not too promising.

In concluding their report on hoisting systems in deep drilling, the Houston Chapter API Study Group wrote: "This group feels that the wire rope manufacturer should do some work to develop a wire rope with more strength for a given diameter. Those present feel that the full effect of modern high-frequency heat treating and annealing, super alloys, etc., have not yet been fully developed, and that the oil industry in particular has bad limitations in design which prevent the use of larger diameter wire rope or more lines in the block. Every effort of concentrated research for wire ropes with higher strength should be incouraged by the industry. It appears that at present, 6 x 19 Seale construction rope with either hemp or wire center offers the best promise for deep drilling."

On the other hand, engineers of wire rope companies say that there are certain considerations involved in the manufacture of wire rope which, thus far, and probably in the future, will make it impossible to use alloy steel in its manufacture. They emphasize that both tensile strength and ductility must be obtained. They feel that, insofar as it now appears, ultimate strength in wire lines to drill deep wells under present design of hoisting equipment will involve greater diameters. They say that experiments with alloy steels made by some wire rope companies have conclusively proven the above statements. Oil men, however, do not give up easily. They say that wire rope manufacturers have been ahead of the industry in providing a product adequate to the drilling industry's needs, and continue to hope for a wire rope which will give substantially greater strength with necessary ductility than, for instance, present 1½-inch wire rope, without an increase in diameter.

Industry's Steel Prospects Favorable

■ CONTINUED FROM PAGE 51

less than one-half the quantity originally estimated for 1949. Further, the committee is advised that all petroleum pipe lines now scheduled for construction during 1949 have an adequate supply of sufficient steel to complete the scheduled work."

It is estimated that during 1949 tanker deliveries of the equivalent of 106 T-2's, both here and abroad, will be made. On the assumption that three-fourths of those estimated for delivery this year will be completed by September 30, there is now an indicated total of 118 T-2 equivalents which will have been built during the 18 months ending September 30, 1949.

The industry developed more refining capacity during 1948 than was contemplated at the beginning of that year. The amount of additional plant capacity to be completed in 1949 will be somewhat less than estimated previously.

The new estimated refinery runs and capacities for 1949 and 1950 are as follows:

	(Thousand Barrels Daily)	
	1949	1950
Estimated refinery runs	5,656	5,910
Estimated refinery capacity, required at 90 percent operating ratio	6,284	6,567
Estimated refining capacity, which will be available	6,458*	6,614
Estimated refining capacity, required at end of period	6,382	6,672
Estimated refining capacity, completed at end of period	6,569*	6,672
Estimated additional refining capacity placed in operation during year (Refining capacity as of 12-31-48, 6,346,900)	222.5*	103

* From Jan. 13, 1949 report of NPC Committee on Petroleum Refining Capacity.

Natural gas transmission line projects approved but not completed require an estimated 1,200,000 tons of pipe in addition to the 1,020,000 tons already delivered as of December 31, 1948. Another 500,000 tons will be needed for gathering lines and other intrastate projects, making a total of 1,700,000 tons. Line pipe in sizes six-inch to 14-inch will become more available, the committee says.

Estimates of the steel requirements of American companies operating abroad are 16 percent lower than those of March, 1948.

By areas, the reductions amount to 25 percent for the Western Hemisphere and 9 percent for the Eastern. By categories, the revised estimates are lower by the following amounts:

	short tons	%
Oil country tubular goods	21,800	10.3
Line pipe (under 16")	24,200	14.2
Line pipe (16" and over)	16,200	7.1
Steel, all others	121,300	22.8

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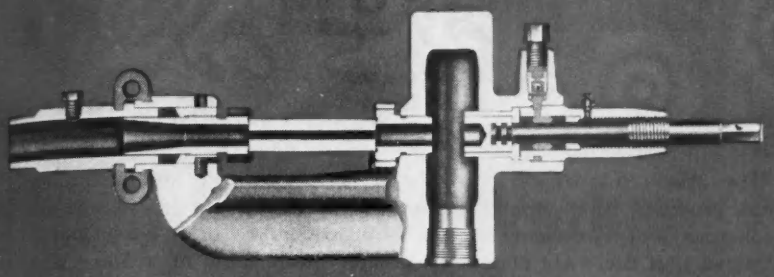

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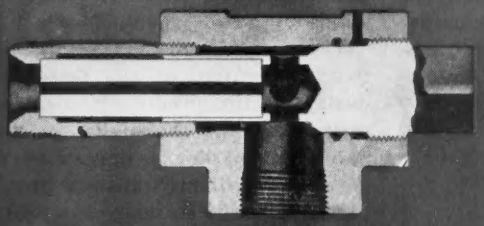

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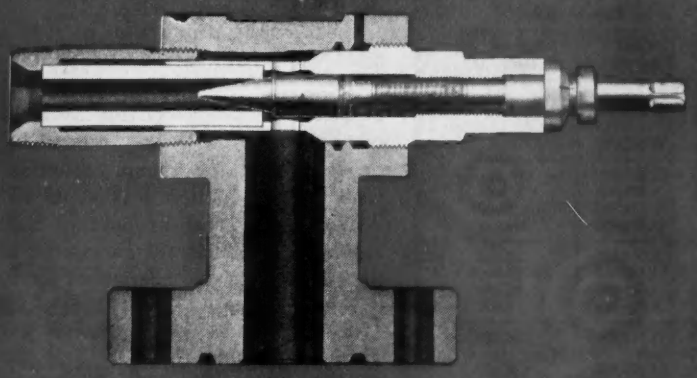

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Larger Companies

Produce 63.7 Percent and Refine 86.2 Percent of U. S. Oil

THE existence of vigorous competition in the American petroleum industry is reflected in the table herewith showing crude production and refinery runs in 1948 for about 30 of the larger companies and for the many other companies and operators in the aggregate.

Crude production is so competitive that 29 of the larger companies accounted for only 63.7 percent of the U. S. total. The other 36.3 percent of production was provided by thousands of smaller concerns and operators. It has been estimated that there are about 18,000 independent operators engaged in drilling and production activities.

Being a manufacturing activity, in which crude goes to central points from wide areas for processing, refining naturally is more concentrated than production. It involves large investment, and economies are afforded by volume output. Consequently, larger companies do a greater proportion of refining than producing. In 1948, 25 companies accounted for 86.2 percent of U. S. crude runs to stills, while the other 13.8 percent of refinery runs represented operations by smaller companies.

These data indicate exceptionally active competition in the petroleum industry in the production and refining divisions, while the highly competitive nature of marketing operations should be evident without statistical proof. The participation of so many competitors in oil industry activities is especially noteworthy when compared with the situations in some of the other leading industries.

U. S. crude production in 1948 averaged 5,508,967 barrels daily. Of this amount, 3,509,696 barrels daily or 63.7 percent was accounted for by 29 larger companies. This is the indicated gross production of the group, assuming that their net production was about 87 percent of their gross production. Subtraction indicates that the remainder of the producing industry accounted for aggregate output of 1,999,271 barrels daily in 1948 or 36.3 percent of the U. S. total. In 1947 the 29 leading companies produced 3,205,476 barrels daily or 63 percent of the U. S. total of 5,085,225 daily for that year, while the rest of the industry produced 1,897,749 barrels.

U. S. crude runs to stills averaged 5,548,279 barrels daily in 1948. Of this total, 4,783,099 barrels daily or 86.2 percent was accounted for by 25 companies and 765,180 barrels daily or 13.8 percent by other refiners. In 1947 the 25 leading refiners processed 4,383,494 barrels daily or 86.4 percent of the U. S. total of 5,074,647 daily, while other refiners processed 691,153 barrels daily or 13.6 percent of the U. S. runs.

In 1946, the 29 leading producing companies averaged 2,973,853 barrels daily or 62.6 percent of the U. S. total of 4,750,518 daily, while others produced 1,776,665 barrels daily or 37.4 percent; and 25 refiners ran to stills 4,039,566 barrels daily or 85.2 percent of U. S. runs of 4,740,266 daily, while others refined 700,700 daily or 14.8 percent.

Domestic Crude Production and Refinery Runs of U. S. Companies in 1948

(Data from Annual Reports of Companies)

COMPANY	Net Domestic Crude Oil Production (Company's Net Share: Does Not Include Royalty and Co-Owner Interests)		Crude Oil Runs to Stills	
	Total Barrels	Barrels Daily	Total Barrels	Barrels Daily
Amerada Petroleum Corporation	22,660,576	61,914	.....	.....
Atlantic Refining Company	27,663,000	75,582	53,271,000	145,549
Barnsdall Oil Company	11,533,581	31,513	.....	.....
Cities Service Company	32,375,000	88,456	72,628,000	198,437
Continental Oil Company	40,553,229	110,801	33,628,342	91,881
Deep Rock Oil Corporation	3,008,520	8,220	4,529,000	12,374
Gulf Oil Corporation	86,154,276	235,394	140,558,250	384,039
‡Humble Oil & Refining Company	134,797,800	368,300	91,300,000	249,454
Lion Oil Company	5,049,260	13,796	8,062,510	22,029
Mid-Continent Petroleum Corporation	7,897,605	21,578	15,483,819	42,306
The Ohio Oil Company	35,227,224	96,249	9,331,000	25,495
Panhandle Prod. & Refg. Company	1,779,851	4,863	1,705,398	4,660
Phillips Petroleum Company	39,880,964	108,964	51,111,274	139,648
Plymouth Oil Company	4,475,607	12,228	.....	.....
The Pure Oil Company	28,104,512	76,788	38,291,565	104,622
Richfield Oil Corporation	9,071,795	24,786	27,014,000	73,809
Shell Union Oil Corporation	78,550,000	214,617	116,258,000	317,645
Sinclair Oil Corporation	33,670,546	91,996	94,591,482	258,447
Skelly Oil Company	22,173,582	60,584	12,073,837	32,989
Socony-Vacuum Oil Company, Inc.	66,868,200	182,700	172,752,000	472,000
South Penn Oil Company	4,114,572	11,242	.....	.....
Standard Oil Company of California	98,783,400	269,900	112,401,581	307,108
Standard Oil Company (Indiana)	80,978,286	221,252	163,998,744	448,084
Standard Oil Company (New Jersey)	156,648,000	428,000	273,036,000	746,000
The Standard Oil Company (Ohio)	11,417,535	31,195	29,456,163	80,481
Sun Oil Company	37,622,512	102,794	63,792,654	174,297
Sunray Oil Corporation	12,337,430	33,709	9,920,424	27,105
The Texas Company	96,339,920	263,224	145,978,509	398,848
Tide Water Associated Oil Company	32,671,310	89,266	59,751,654	163,256
Union Oil Company of California	29,947,000	81,822	40,989,000	111,992
*Total Above Companies	1,117,557,293	3,053,435	1,750,614,206	4,783,099
(Percent of U. S. Total)	55.4	55.4	86.2	86.2
†Royalty & Co-Owner Oil Produced, Est.	166,991,320	456,261	.....	.....
†Gross Prod., Above Companies, Est.	1,284,548,613	3,509,696	.....	.....
(Percent of U. S. Total)	63.7	63.7	.....	.....
Rest of Industry	731,733,387	1,999,271	280,055,794	765,180
(Percent of U. S. Total)	36.3	36.3	13.8	13.8
Total, United States	2,016,282,000	5,508,967	2,030,670,000	5,548,279

* Production of 29 companies; refinery runs of 25 companies. † Net production of above companies (their net share) is here estimated as representing 87 percent of their gross production; and production for account of royalty and co-owner interests is estimated as 13 percent of gross.

‡ Humble Oil and Refining Company's data are included with those of Standard Oil Company (N.J.) and are not duplicated in totals.

The Relation of Foremen and Supervisors to Workers and Worker Representatives

By EDWIN W. MORRIS
Assistant Director of Industrial Relations, Hughes Tool Company

PRESENT-DAY problems of supervisor-employe relations are considerably affected by past events, and it is well to review some of the things that have led to the problems of today.

The fundamentals of good human relations in industry are the same whether unionization is present or not. The presence of a union, however, means the introduction of certain formalized procedures under a labor contract which, in many instances, are not present in the absence of a union. This problem should be approached from the point of view that what is good employe relations without a union is also good employe relations with a union. At the same time it would be well to consider labor contracts, formal grievance procedures, and other things which more often are found where a union exists.

There are two phases of historical development which affect supervisor-employe relations today. One of these has to do with the growth and development of labor unions in this country, and the other has to do with independent attempts to establish a more scientific approach to the field of supervisor-employe relations in industry.

Some of the significant developments in the field of labor relations affecting present-day conditions may be summarized as follows:

1. The early days of labor organization in this country were marked by violence and bitter feeling on the part of the opposing parties. A great deal of present-day unrest is due to the fact that both labor and management representatives still bear scars and memories of past abuses. Therefore a primary consideration in successfully dealing with present-day personnel problems is to overcome the bitterness and prejudices of the past. A review of the history of the organization in the coal mines, steel industry, railroads, and others, is adequate reminder that we are not too far removed from the days of violence.
2. Some more recent events and conditions which influence present-day supervisor-employe relations are as follows:

   A. Formation of the CIO in the early '30s.

   B. Experience with collective bargaining under the National Industrial Recovery Act.

   C. Passage of the National Labor Relations Act, and the subsequent Supreme Court decision upholding its constitutionality.

   D. Personnel shortages and training problems during the "defense" and "war" period.

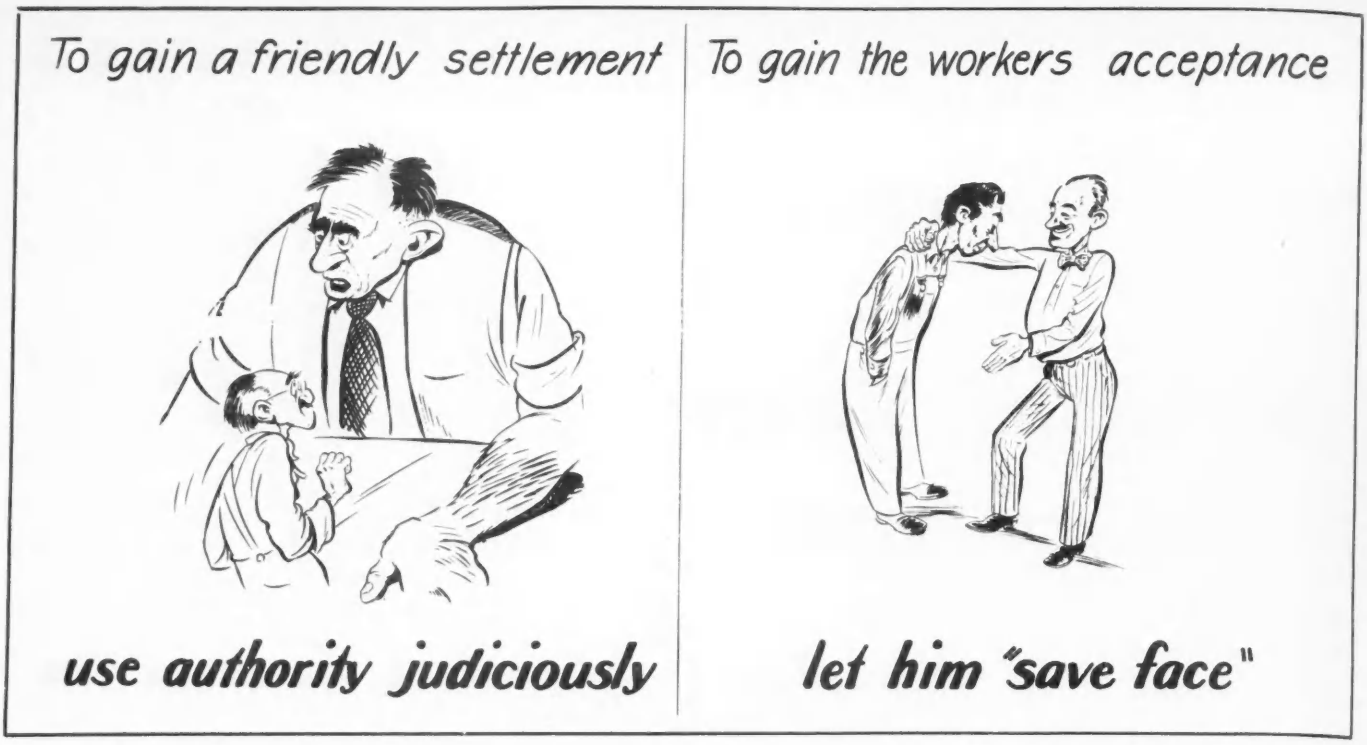
   E. The influence of the War Labor Board decisions on labor relations—especially the influences of "third party" intervention in collective bargaining.

   F. The wide-spread strikes in 1946.

   G. Passage of the Labor-Management Act of 1947.

The events indicated above have focused our attention considerably on the field of employer-employe relations and collective bargaining, and since in employe relations we have a national policy of settling differences of opinion by collective bargaining, it is important that we appreciate what makes collective bargaining work. True collective

GOOD EMPLOYE relations, with or without unionization, require not only good physical working conditions and satisfactory material compensation, but also, and more important, the satisfaction of certain non-material needs and desires of workers. One of the principal non-material compensations required to make employes happy and efficient in their work is the genuine understanding and interest of foremen and supervisors in their relations with the employes. The supervisor should try to see things from the employe's point of view, develop the employe's feeling of responsibility, be tactful in criticism, be really interested in individual employes, strive for a pleasing personality, make promises only after careful thinking and then be sure to fulfill them.



LEFT: 1. Establish feeling that "facts" will determine the issue rather than "authority." 2. Remember that an arbitrary decision may be received rebelliously. 3. Don't let your authority repress free expression by the worker.

RIGHT: 1. Make it easy for him to retreat. 2. Don't force him to admit that he came in "half-cocked." 3. Use some statement like "I would probably feel the same as you, if I had only part of the information. 4. If possible yield some trivial concession in order to let him "save face."

bargaining can exist only when we have the following conditions:

A. Reasonable equality of power and position.

B. Fixed and accepted legal and moral responsibility of the parties.

C. Good faith on the part of both parties.

D. Neutrality of government.

The presence or absence of these conditions directly affects labor relations in any plant under the present national policy of settling employer-employe disputes by collective bargaining.

While these events have been taking place in the field of labor organization, we have continued to make phenomenal progress in technological and engineering fields. Unfortunately, our progress in the field of coordination of human effort in industry has not kept pace with these technical and engineering developments, and many of our problems today are a result of our failure to have and use a more specific set of guides and rules in supervisor-employe relations.

This field, however, has not been without progress. Of particular significance in this respect is one research project conducted a few years ago at the Hawthorne Plant of the Western Electric Company by Professor F. J. Roethlisberger of Harvard, and his associates. The results of his findings are published in "Management and the Worker" and "Management and Morale." Although these experiments started out originally to measure the beneficial effect of good physical working conditions, they assumed a much broader scope, and it was found that certain non-material aspects of working conditions were much more important than the physical aspect of working conditions with repect to productivity.

The researchers established the value of group participation. They observed some measurable results from letting employes in on problems affecting them. They found the value of recognition of the individual and of enhancing his sense of personal dignity. They found that employes working together in natural groupings in which there was a congenial work group, with respect to both the employes and their supervisors, had much higher productivity than other groups. In short, it might be said that by scientific processes they discovered that "people are human."

This series of experiments, together with other work in the same field conducted from unprejudiced and objective points of view, certainly points to the conclusion that the continued successful operation of our business system depends upon the ability of industry to provide something more than an abundance of goods and services. It is now a generally accepted belief that when an employe acquires a certain minimum amount of material things, his non-material needs or desires become more important than the further accumulation of material goods. Furthermore, the source of many of these non-material needs is the relationship existing between the employe and his "boss," and it is often this relationship which exerts the most influence over the employe's opinion of his company and the business system in which it operates. An employe's opinion of his company and of the business system in which it operates, depends chiefly upon the relationship between him and his "boss." Therefore, supervisor-employe relations are important, not only from the standpoint of influence within our individual businesses, but also from the standpoint of the influence upon public opinion.

The factors affecting relations of foremen and supervisors to workers and worker representatives may be considered from several viewpoints. Briefly these are as follows:

1. LEGISLATION: Adherence to legal requirements can be considered only the minimum effort on the part of the employer, and there is little chance of really good supervisor-employe relations if legal requirements are the sole basis of that relationship. Federal and state laws do, however, outline certain bounds of conduct for both parties, including such important matters as the

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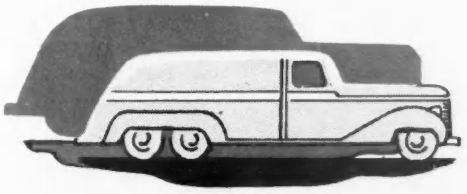

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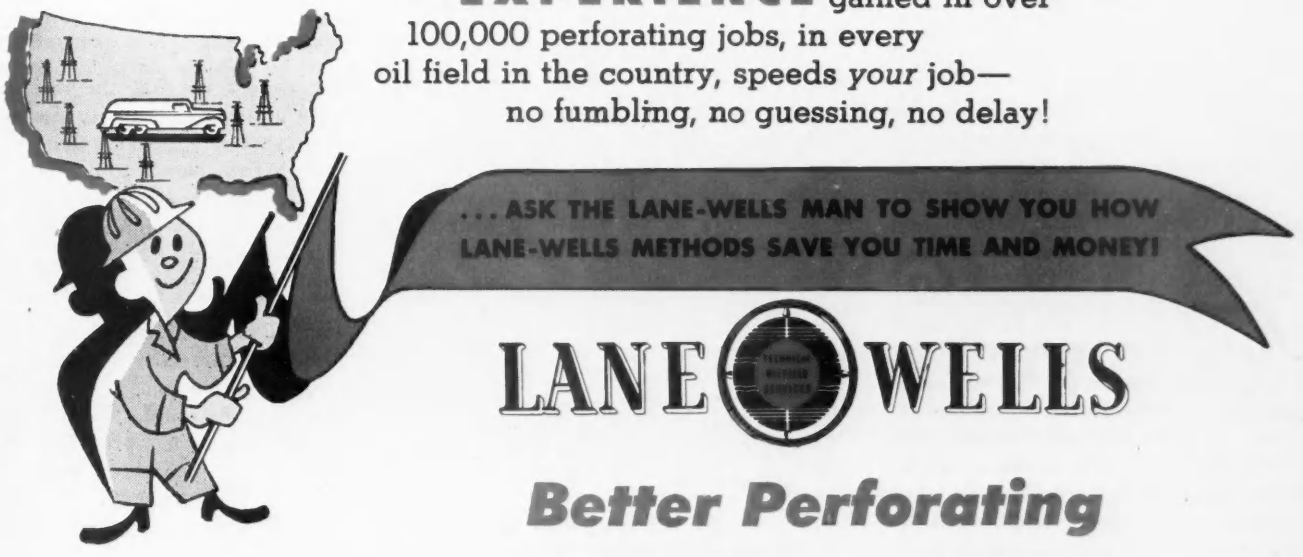

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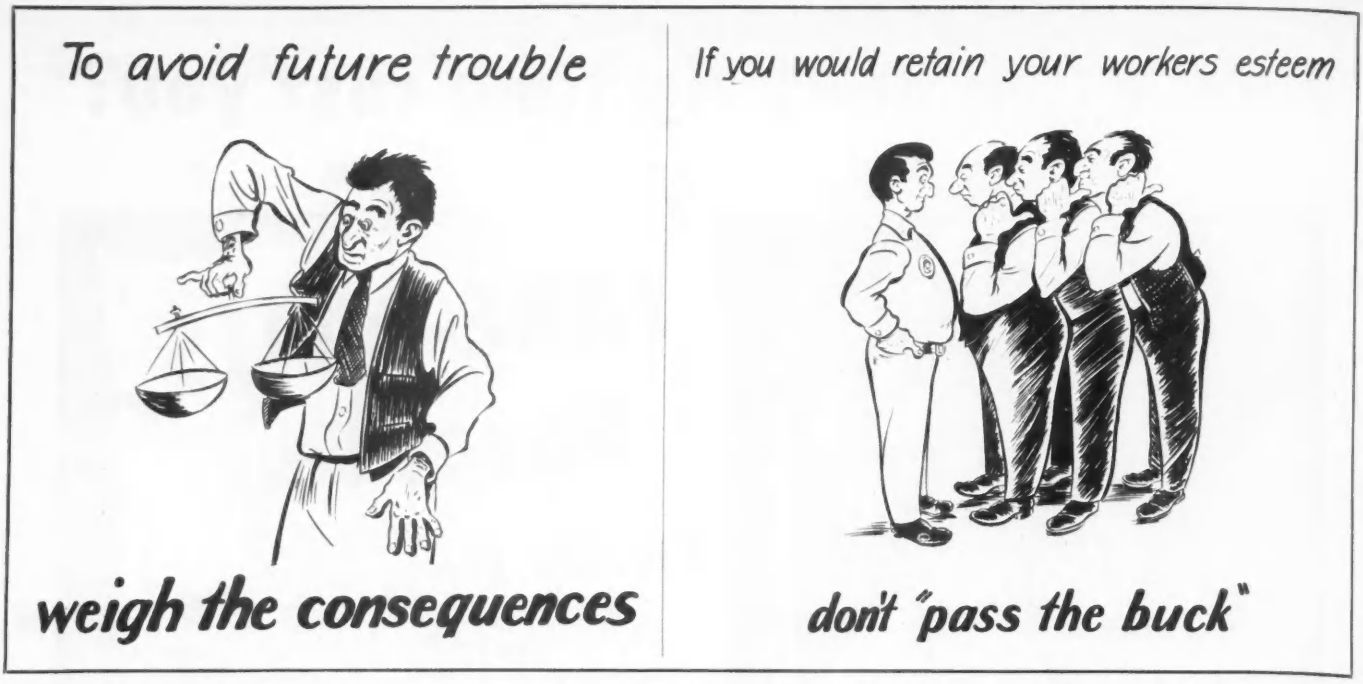


LEFT: 1. Consider future relationships both with the aggrieved man and other workers. 2. A settlement may be *logical* but not *psychological*.

RIGHT: 1. The worker feels that he is being given the "run-around." 2. Saying, "that's over my head" increases the worker's feeling of futility. 3. Saying "I'd do it but it's against company policy" tends to give the worker the impression that you agree with him and increases his feeling of being right. 4. If you do not have the authority, frankly state that you do not, but that you will find out from the person who does.

right to organize, the fixing of responsibilities of both parties, freedom of speech, unfair labor practices by both parties, representation elections, compulsory union membership, and other related matters.

2. THE LABOR CONTRACT is an important factor affecting the relations between the supervisor and the workers and worker representatives in that it becomes the "Rule Book" setting forth such matters as the rights of both parties and the grievance procedure. In this connection, it is important to realize that a good contract is one that is good for all parties. Most people working in this field will readily recognize the importance of speedy settlement of grievances with line supervision—especially first line supervision. Also of great importance in connection with the labor contract is the matter of thoroughly familiarizing all line supervisors with the provisions of the contract as soon as a new one is negotiated in order that they will have first-hand information regarding the rules under which they may operate, and know the reasons for the provisions of the contract.

3. RELATIONS WITH EMPLOYE REPRESENTATIVES also affect supervisor-employe relations. The presence or absence of a union should not make a real difference in this relationship. As has been indicated before, what constitutes good human relations without a union should also constitute good human relations with a union. Unfortunately, however, the attitude of the company toward the union or the union toward the company, may be of such an antagonistic nature that a definite influence will be felt. Quite obviously, as long as this feeling of antagonism exists on the part of either one, or both, employes cannot help but be confused regarding the true attitude of the company and its supervisory personnel toward workers.

4. THE PRACTICE OF GOOD HUMAN RELATIONS is probably the most important factor in this matter of employe relations, and it is here that much can be done. In addition to the findings by Professor Roethlisberger of incentives and basic work motives, the personality characteristics possessed by supervisors are very important in their relations with subordinate employes. Much has been written and spoken about "how to get along better with people," but it is a fact that adherence by supervisors to the following simple rules can go a long way toward providing cooperative supervisor-employe relationships:

A. The supervisor should constantly strive to see things as his workers view them. Only in this way can he fully appreciate and understand their feelings.

B. He should try constantly to build up his subordinates' sense of importance. Developing an employe's feeling of responsibility usually has a very strong influence on the employe's attitude toward his supervisor and company.

C. He should develop the art of constructive criticism. A negative or harsh approach to correcting an employe's actions or attitudes is a sure cause of resentment that may last for years and show up in multiple ways to the company's disadvantage.

D. He should develop a genuine interest in his subordinates. Interest leads to a greater understanding of them as individuals, and beyond that, to securing their positive cooperation.

E. He should develop the mechanics of a pleasing personality; including a sincere and genuine skill in remembering names and faces, presenting a pleasant and cheerful appearance, remembering dates and personal events, and listening attentively to his employes.

F. He should acquire the habit of thinking carefully before making promises of action, and then make certain he fulfills them. Supervisors' broken promises have fanned the flame of many employe's uncooperative attitudes toward their boss and their company.

IPAA Says:

Government Should Limit Imports

By L. J. LOGAN
Associate Editor

STRONG OPPOSITION to imports of oil into the U. S. now is offered by independent operators under leadership of the Independent Petroleum Association of America.

IPAA leaders declare that present and prospective surpluses of oil in world markets make inevitable large imports and serious impairment of domestic industry unless the U. S. government imposes limitations.

ADVERSE effects of imports upon the U. S. domestic oil industry were discussed in fighting mood at the mid-year meeting of the Independent Petroleum Association of America at New Orleans May 1-3. Voluntary limiting of imports by the importing companies was declared inadequate, and directors of the association adopted a resolution urging Congress to limit imports through governmental action, to assure a healthy domestic industry and an adequate supply of oil for normal and emergency needs of the nation.

It was conceded by several leaders of the association that some progress is being made in curtailment of imports through voluntary action of importing companies. But these men asserted that voluntary limiting of imports would be a failure, just as voluntary proration of domestic production proved unsuccessful. It was pointed out that importers cannot legally make agreements to determine imports and that independent action by the different importers will be ineffective because curtailment by some companies can be offset by increased imports by other companies and shipments into the U. S. by non-American companies.

Effective action that the government can take is narrowed down largely to two courses, in the opinion of some of the IPAA leaders thoroughly familiar with the problem. These two solutions are (1) effective tariffs on imports, which have been made ineffective by the reciprocal trade agreements of recent years; or (2) governmental quotas limiting imports.

Leaders of the association conceded that getting Congress to act on imports will be difficult and declared that the independents must thoroughly acquaint the public with the problem and enlist public support. The public should realize that a strong domestic oil industry is vital to the nation's welfare and safety, it was stated, and the organized independents have a duty to publicize the import problem and secure public support of import limitations.

It was stressed that the import problem will last indefinitely. For many years there will be large supplies of petroleum available for world markets, pointed out a speaker, and proved and potential reserves are well distributed over the world.

In 1948 all areas of the world outside the U. S. had surplus production of 250,000 barrels per day, said Russell B. Brown, general counsel for IPAA, and a foreign surplus of 1 million barrels per day is indicated within the near future. For the foreign countries of the Western Hemisphere considered alone said Brown, there was a surplus of 750,000 barrels per day in 1948, and by 1951 this surplus will be 1 million barrels daily. The prospective world surplus of 1 million barrels per day will be without market outlet other than what may be provided by U. S. imports.

Excessive Imports Danger

While American importing companies might be willing to follow the policy of not letting imports displace domestic production, said Brown, there would still be danger of excessive imports. Oil in the hands of non-American companies will soon be seeking a market in the U. S. Also, foreign governments that have granted concessions to American companies will exert pressure on those companies and perhaps on the U. S. government seeking to open U. S. markets to their oil. Legislation is needed, Brown asserted, to provide definite limitations on oil imports, flexible in character so as to permit imports when needed to supplement domestic supply and to give positive limitations when not so needed. Such a policy is essential, he said, to assure a strong domestic industry, capable of meeting oil needs at all times and under all emergencies.

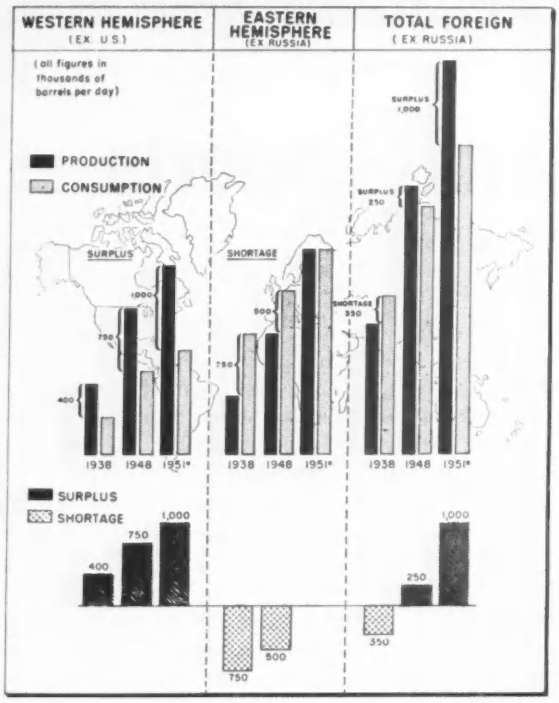
The first and second World Wars demonstrated U. S. dependence upon adequate domestic supply of petroleum reserves immediately available in time of war, declared IPAA directors in their resolution on imports. Ample productive capacity and available reserves can be maintained only by active exploration and development, encouraged by full use of domestic reserves within sound conservation practice. "Any limitation upon this use," the resolution stated, "destroys the ability of the industry to finance the exploration and development of the reserves necessary to a sound national defense." It added that the nation traditionally has been dependent upon the 18,000 independent producers for the discovery of more than 75 percent of new oil fields.

"The ill-considered effect of imports is already taking its toll," stated the resolution. "Markets for domestic crude are being curtailed. Funds for domestic explorations are being limited. Employment of our people for the expansion of our domestic industry is being lessened. Tax revenues are falling. States, counties, cities and school districts are finding themselves with insufficient funds for their operation.

"The domestic industry is fully able to meet all national market demands for petroleum products without waste." Domestic production has been curtailed, the resolution stated, to the extent of 750,000 barrels per day, and imports have been amounting to 600,000 barrels daily and replacing domestic oil. Results of displacing domestic crude oil were listed as promotion of monopoly and reduction of the U. S. to a position of dependence on foreign oil.

In concluding the resolution, IPAA directors urged Congress "to take action immediately to make effective a sound national policy as to petroleum imports that will limit these imports, prevent the deterioration of the petroleum industry in the United States that is now threatened, and thereby preserve the strength

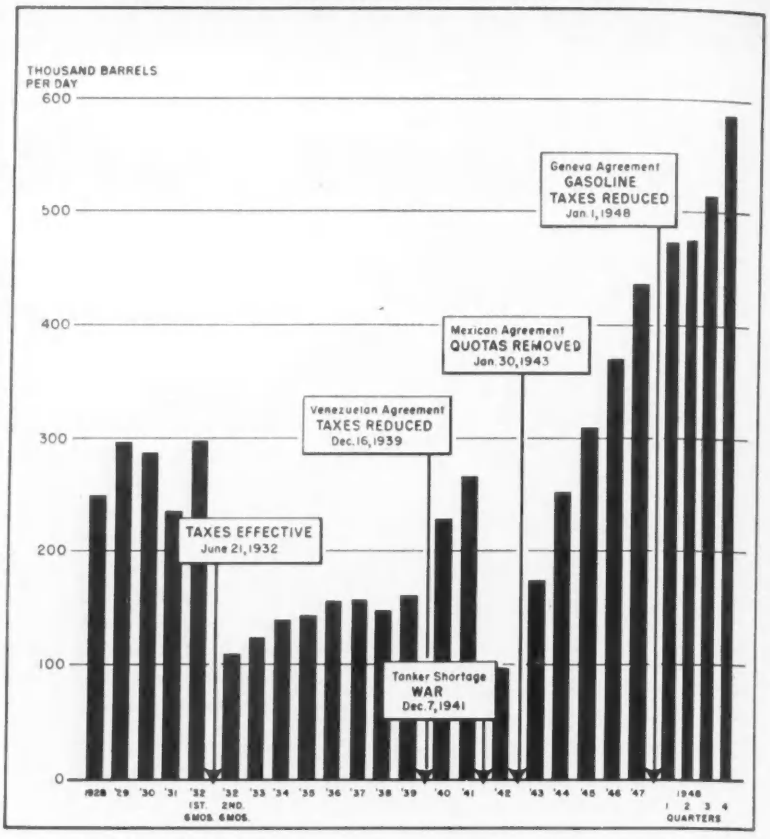
FOREIGN PETROLEUM SUPPLY AND DEMAND



	WESTERN HEMISPHERE (EX U.S.)		EASTERN HEMISPHERE (EX RUSSIA)		TOTAL FOREIGN (EX RUSSIA)	
	Production	Consumption	Production	Consumption	Production	Consumption
1938	850,000	450,000	700,000	1,450,000	1,550,000	1,900,000
1948	1,750,000	1,000,000	1,450,000	1,950,000	3,200,000	2,950,000
1951*	2,250,000	1,250,000	2,450,000	2,450,000	4,700,000	3,700,000

* Based on continuation of present trends.

PETROLEUM IMPORTS INTO U. S., 1928-48



Source: Import data from U.S. Bureau of Mines.

LEFT: Greatly influencing U. S. oil imports are conditions of supply and demand outside the U. S. In 1938 U. S. supplied deficiency of 350,000 barrels daily for rest of world. In 1948 there was a foreign surplus of 250,000 barrels per day, and by 1951, according to estimate, foreign areas will have available production 1 million barrels per day in excess of foreign consumption.

RIGHT: This chart shows how government policy has directly influenced imports. Import taxes cut imports in 1932 and held them relatively low during the 1930's. Subsequently, reciprocal trade agreements and other government action sharply increased imports.

of the domestic industry so essential to our national safety."

Imports have been an important problem for many years, said Brown in his address. He offered charts to show that volumes of imports are influenced especially by (1) government policy and (2) the supply of petroleum produced outside the U. S. and its relationship to oil consumption of those foreign areas.

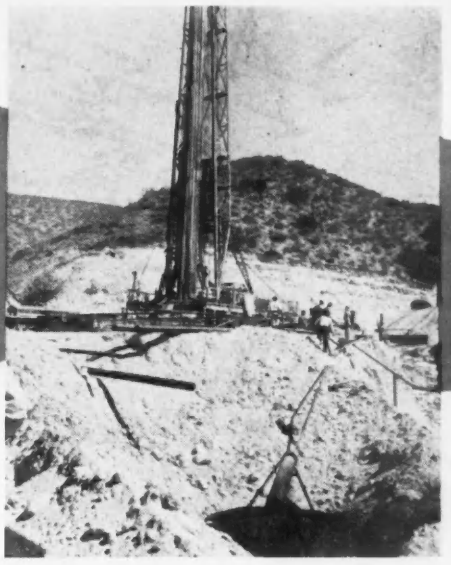
One of the charts showed the trend of imports over the past 20 years. It showed that large imports of 1928-1932 were sharply reduced by tariffs imposed June 21, 1932. Imports continued relatively low through 1939, but as taxes subsequently were reduced under reciprocal trade agreements, imports increased sharply.

In another chart Brown showed changes that have occurred in world supply and demand since 1938. In 1938 total consumption outside the U. S. exceeded total foreign production by 350,000 barrels daily and the U. S. supplied the deficiency. A 750,000-barrel deficiency of the Eastern Hemisphere was supplied only to the extent of 400,000 daily by available surplus of the Western Hemisphere outside the U. S. In 1948 total production outside the U. S. exceeded consumption by 250,000 barrels daily, an excess accounted for by foreign stock accumulations and net imports into the U. S. The Western Hemisphere outside the U. S. had a surplus of 750,000 barrels daily above consumption, while the Eastern Hemisphere had a deficiency of only 500,000 daily in production. In 1951, according to the chart, total foreign production that will be available will exceed total foreign consumption by 1 million barrels daily. Production and consumption will be in balance for the Eastern Hemisphere, but in the Western Hemisphere outside the U. S. consumption will be 1 million barrels a day less than available production.

IPAA directors at New Orleans also adopted two other resolutions, concerned with the ECA program and proposed oil loans to Mexico. In the ECA resolution they opposed "use of public funds for petroleum supply and development in foreign areas beyond that required to meet recovery needs of the foreign areas participating in the ECA program," and urged that Congress "limit the use of funds for the ECA program so as to make certain that no funds are expended for petroleum needs in excess of that necessary for use in the areas being rehabilitated." The funds should not be used, said the resolution, "to build up a potential source of petroleum and petroleum products to compete with the domestic petroleum industry both abroad and at home."

In the resolution on oil loans to Mexico, the directors condemned U. S. government consideration of a loan of hundreds of millions of dollars to Mexico for developing petroleum resources in that country. The U. S. government "has not participated in direct financing of petroleum development within this country," stated the resolution, "and such assistance is inconsistent with and repugnant to the free enterprise system. The world is now faced with a long-range surplus of petroleum, and U. S. taxpayers should not be called upon to subsidize production of foreign oil." The report added that "Sufficient capital can be made available through normal commercial channels and under private enterprise if the proper opportunities are offered by countries interested in expanding development of their oil resources. This has been recently demonstrated by the fact that Mexico has negotiated with private enterprise for the exploration of certain of her areas."

New Cuyama Discovery Is Significant Addition to California Reserves



RICHFIELD'S HOMAN A No. 81-35 South Cuyama field discovery. Picture was taken just as well started to flow to sump in foreground. Spray of oil visible in derrick occurred when swab was pulled up through lubricator and before flow could be switched into flow line.

By GILBERT M. WILSON
Staff Writer

AN IMPORTANT ADDITION to California reserves is promised by the prolific wildcat producer completed by Richfield Oil Corporation in the South Cuyama area of Cuyama Valley.

Located 5½ miles southeast of Russell Ranch field, this new discovery was estimated to have flowing capacity of 5088 barrels per day of 34-gravity oil. From 4095 feet to 4392 feet, where the bit still was in oil sand, there was a nearly solid body of well saturated, permeable oil sand, broken by only a few small streaks of shale.

Cuyama Valley lies parallel with and between the producing provinces of San Joaquin Valley and the Coastal region and contains similar formations. Other structures have been mapped in Cuyama Valley, indicating more fields will be opened.

THE discovery of what appears to be another major oil field in California's Cuyama Valley became apparent last month with the completion by Richfield Oil Corporation of "Homan A" No. 81-35 for an estimated initial flowing production rate of 5088 barrels per day of 34-gravity oil and 1500 Mcf of gas from a total depth of 4392 feet. After a day of testing, the well was beaned back to a 580 barrels per day rate through 20/64 orifice with cut less than 1 percent, most of it being drilling mud. Tubing pressure was 390 pounds, packer being set just above the liner top.

Stabilized production as of May 11 was 606 barrels per day of 33.8-gravity oil cutting 0.6 of 1 percent bottom sediment and water through 22/64 bean, along with 238 Mcf of gas. Tubing pressure was 410 pounds. Tubing is hung on packer at 3990 feet.

This discovery, in the foothill area about 5½ miles southeast of the highly productive Russell Ranch field discovered last June, apparently also produces from the same interval . . . the Dibblee zone of the Vaqueros (L. Miocene) formation.

Of particular interest is the surprisingly great thickness of oil sand found in this well. The interval from the shoe of the 8⅝-inch water string set at 4095 feet down to a total depth of 4392 feet, where the bit still was in oil sand, was a nearly solid body of well-saturated, permeable oil sand.

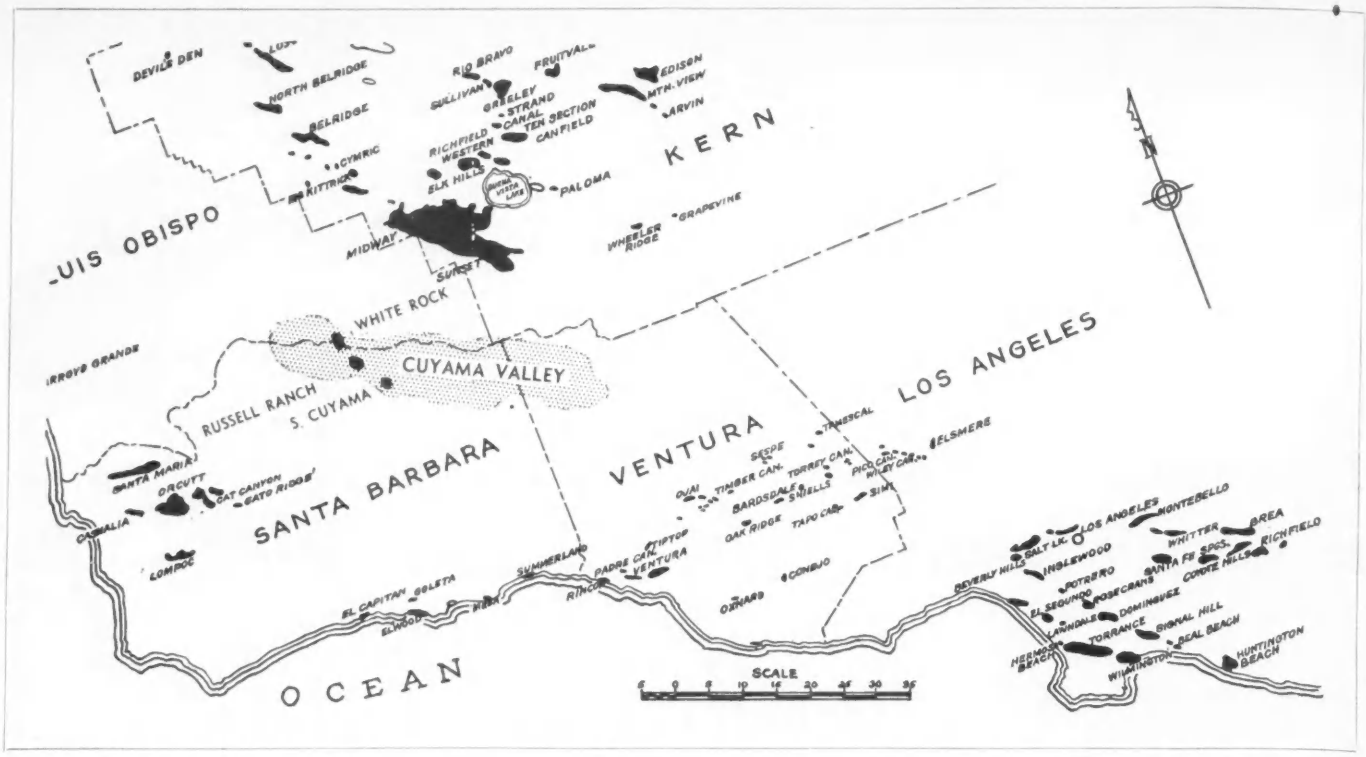
In subsequent wells, one of which, a direct easterly offset, already is drilling, the company plans to explore the full extent of the oil sand.

There is speculation that the new field, now known officially as the South Cuyama, may have more than one producing horizon. In the Russell Ranch field, production also is found in the Colgrove sand. This zone is several hundred feet below the Dibblee, and covers an area perhaps one-fourth to one-third as great in areal extent as that found productive in the Dibblee.

Although Richfield holds the largest share of the acreage thought to be on structure, several other companies, one of them The Superior Oil Company, have offsetting or nearby acreage, and new locations are being drilled or plans being made for early development.

Spudded April 2 on a structural high determined by both geophysical and surface exploratory work, the well marks the 73rd successful completion by Richfield in the Cuyama Valley area since the initial discovery well in the Russell Ranch field was brought in last June (WORLD OIL, August, 1948). In addition to those wells completed by Richfield, Hancock Oil Company, on acreage in the White Rock portion of the Russell Ranch field, has brought in seven successful wells. At the present time, seven strings of tools still are drilling in the Russell Ranch field. With the exception of a few edge wells which made small pumpers, all wells so far brought in are flowing at curtailed rates of from 200 to 250 barrels per day of 34- to 38-gravity oil. Total daily production in the valley is in excess of 17,000 barrels per day. This record is even more impressive when it is recalled that up until a year or two ago, the valley was considered by most companies as a non-productive area; this, in spite of the fact that it lies parallel to and between the producing provinces of San Joaquin Valley and the Coastal region, and in addition, contains formations similar in many respects to those in adjoining producing areas.

During the last week in April the pipe



line outlet for the valley was increased by 35,000 barrels capacity when Richfield completed the laying of a 30-mile, eight-inch, mastic-coated line between the firm's Russell Ranch tank farm and Lake Station near Maricopa in San Joaquin Valley. The new line roughly parallels, but is several miles shorter than the six-inch war surplus invasion pipe line laid last summer. This temporary line, put down at a time when delivery of regular pipe could not be obtained in time to handle the fast-growing output of the Russell Ranch field, will be allowed to remain in the ground to serve as reserve capacity in the event capacity of the eight-inch line should be exceeded in the course of future development.

At present there is no commercial outlet for gas produced in the valley. Until now much of it has been injected back into the producing formation. A gasoline extraction plant presently is under construction in the White Rock portion of the Russell Ranch field and it is planned, following completion of this plant, to return all dry gas into the formation.

There is every reason to believe that other fields still are to be found in the valley. A number of structures, each having characteristics similar to the fields found thus far, already have been mapped by Richfield and other companies, and plans currently are being made to test them in the near future. The relatively shallow depths of the fields so far developed, plus the desirable high gravity crude and apparently long flowing life of the wells, are reasons that will assure a high rate of activity in the valley for some time to come.

Oil Scouts and Landmen to Meet in Houston June 9-11

Oil scouts and landmen will meet in Houston June 9-11 in the 26th Annual Convention of the National Oil Scouts and Landmen's Association at the Shamrock Hotel. Robert (Bobby) Wilson, scout for Sun Oil Company at Houston, second vice president of the association, is general chairman of the convention and heads the general committee responsible for all arrangements.

Dr. T. A. Link, consulting geologist of Toronto and Calgary, Canada, and vice president of the American Association of Petroleum Geologists, will discuss Western Canada's booming oil industry at the afternoon session, June 10.

Economic phases of the industry will be contained in a talk to be given by R. B. Anderson, president, Texas Mid-Continent Oil & Gas Association and manager of the W. T. Waggoner Estate, Vernon, Texas.

Lieut. Gov. Allan Shivers of Texas will make the welcoming address to the convention Friday morning, after which Anderson and Link will speak. A movie on development of the Gulf of Mexico continental shelf will be shown, followed by a stag party.

Dr. T. A. Link

R. B. Anderson

A business meeting of the association and election of new officers will be held June 11.

Officers of the association are as follows: president, Simon Crites, Phillips Petroleum Company, Corpus Christi, Texas; first vice president, H. W. Pontius, Ohio Oil Company, Midland, Texas; second vice president, Wilson, Sun Oil Company, Houston; third vice president, O. L. McNew, Amerada Petroleum Corporation, Casper, Wyo.; and secretary-treasurer, Howard Pierce, Midstates Oil Corporation, Wichita, Kansas.

The important General Committee responsible for all arrangements in connection with the convention consists of W. E. Brown, Shell Oil Company and president of the Houston Oil Scouts & Landsmen's Association; Paul Edman, Tide Water Associated Oil Company; Dave Francen, Humble Oil & Refining Company; John Wilson, Ohio Oil Company; W. L. Miller, The Superior Oil Company; T. E. Weatherly, The Pure Oil Company; and A. D. Hunter, Humble, all of Houston.

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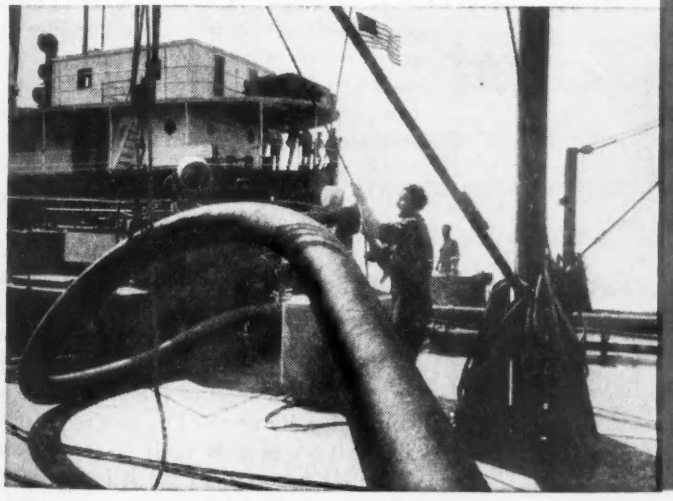

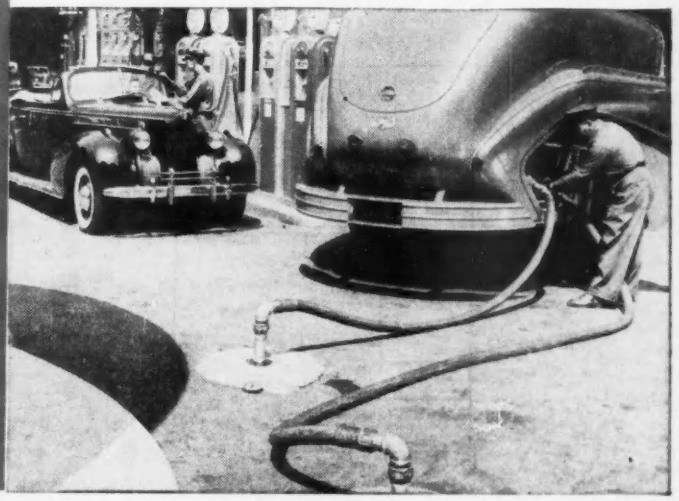

for the Oil Industry

Prospecting in Northwest Arkansas

By KEN R. BURNS
Consulting Engineer, Tulsa

SEVERAL WELLS drilled near Fayetteville, Madison County, northwest Arkansas, have yielded evidence of oil and gas in the Mississippian, although commercial production has not been obtained. Presence of a basin has been indicated, but more drilling is needed to give definite conclusions. Reconnaissance work by radarology may indicate evidence of structure.

Developments have stimulated reconnaissance work in Madison County and also in adjoining Washington and Benton counties, and results indicate that many local areas throughout northwest Arkansas merit closer investigation.

SEVERAL wells drilled in the vicinity of Fayetteville in Madison County have revealed some interesting geological conditions and further development may open this northwestern section of Arkansas for oil and gas production. The existence of a potential basin area appears to have been confirmed, although more drilling is necessary to properly evaluate the possibilities of the region. Additional interest is noted in the operations inasmuch as some preliminary reconnaissance work has been done employing radarology, a technique developed since the war, and the survey data of the area is herewith presented as Figure 2.

Location

The area under consideration is located in 15n-27w, near the settlements of Georgetown, Japton and Asher. The tests are 12 miles southwest of Huntsville, the seat of Madison County, and about 24 miles southeast of Fayetteville, the largest town in the Ozark region and also the county seat of Washington County. (Figure 1 indicates the general area; Figure 2 shows the drilling sites). The roads are second class all-weather roads and the terrain is rugged consisting of deeply dissected plateaus which rise to a height of about 2300 feet. The water shed is drained by Drake's Hog and Richland Creeks which flow into the White and War Eagle rivers which surround the area.

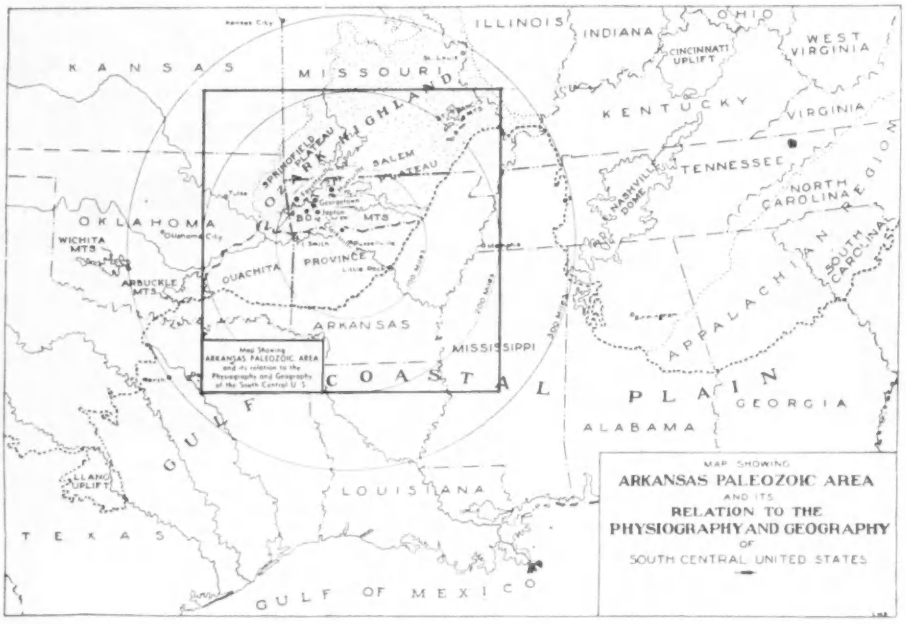

FIGURE 1

Geology

Geologically, the area lies within a belt of Paleozoic rocks which include sediments of Pennsylvanian and Ordovician ages. The area is subdivided into the province of the Ozark Highlands and the formations include beds of limestone, shale, sandstone, dolomite, chert and conglomerate which are fossiliferous particularly when they occur in the Carboniferous measures. Potential oil-bearing horizons are unusually shallow and include the Fayetteville, Boone, St. Peter and Arbuckle formations. A generalized geological section of the area is presented in Figure 3.

Figure 4 is a surface map detailed by H. L. Scott and the contours at ten-foot intervals are based on the Brentwood limestone and the Hale sandstone. Apparently an extensive anticline is folding into the major fault of the area, which is known locally as the Drake Creek fault. The extent of this fault has not been definitely ascertained but it is known to extend from the SE 12-15n-28-w, northeastward to SW 33-17n-26w. At the north end of the fault along Holman Creek it passes into a monocline, but the Moody Hollow fault continues the displacement along the same line further to the northeast. The downthrow of the fault is to the southeast and the dis-

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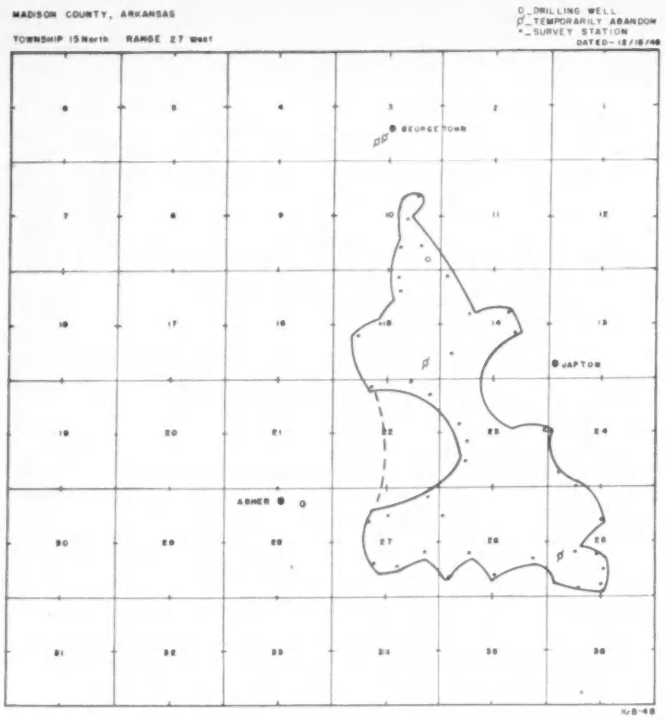
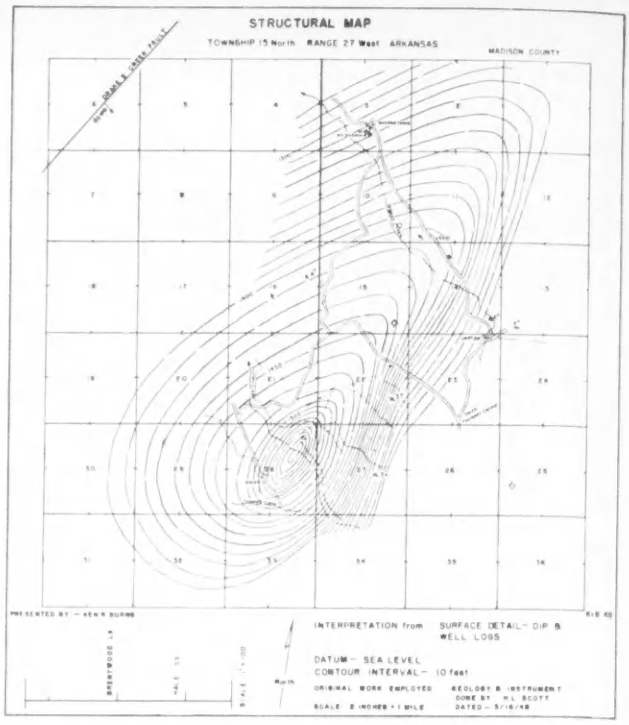
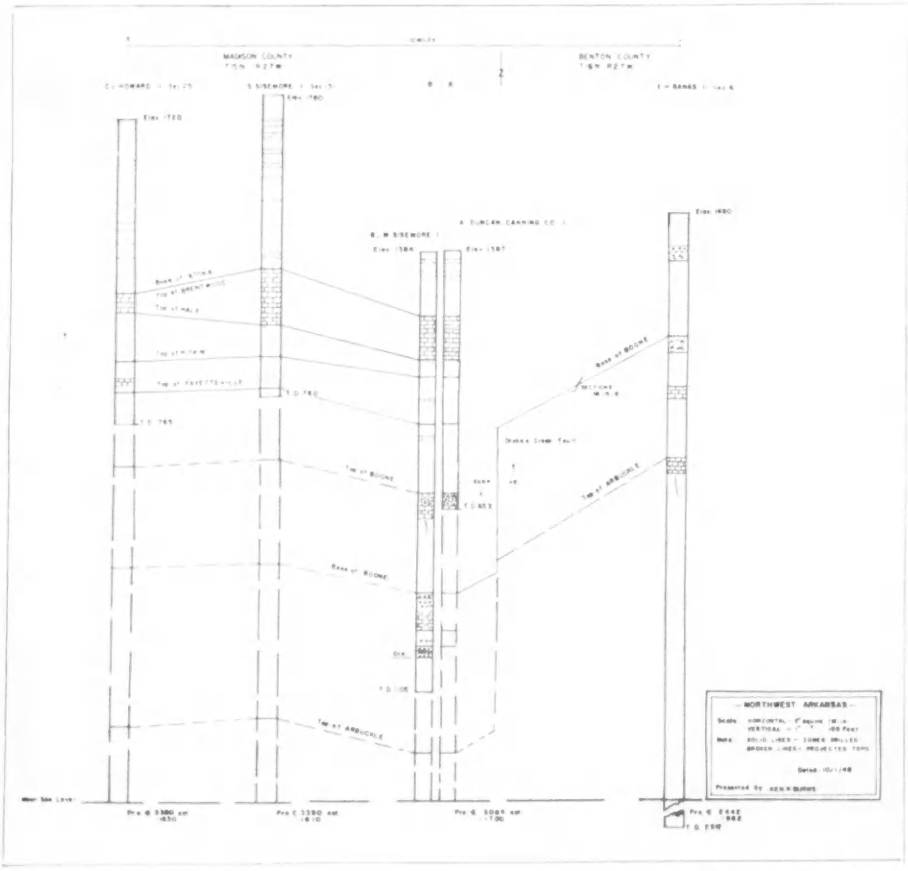



STRUCTURAL MAP
TOWNSHIP 15 North RANGE 27 West ARKANSAS
MADISON COUNTY
INTERPRETATION from SURFACE DETAIL - DIP & WELL LOGS
DATUM - SEA LEVEL
CONTOUR INTERVAL - 10 feet



TOP LEFT: Figure 2.

LOWER LEFT: Figure 3.

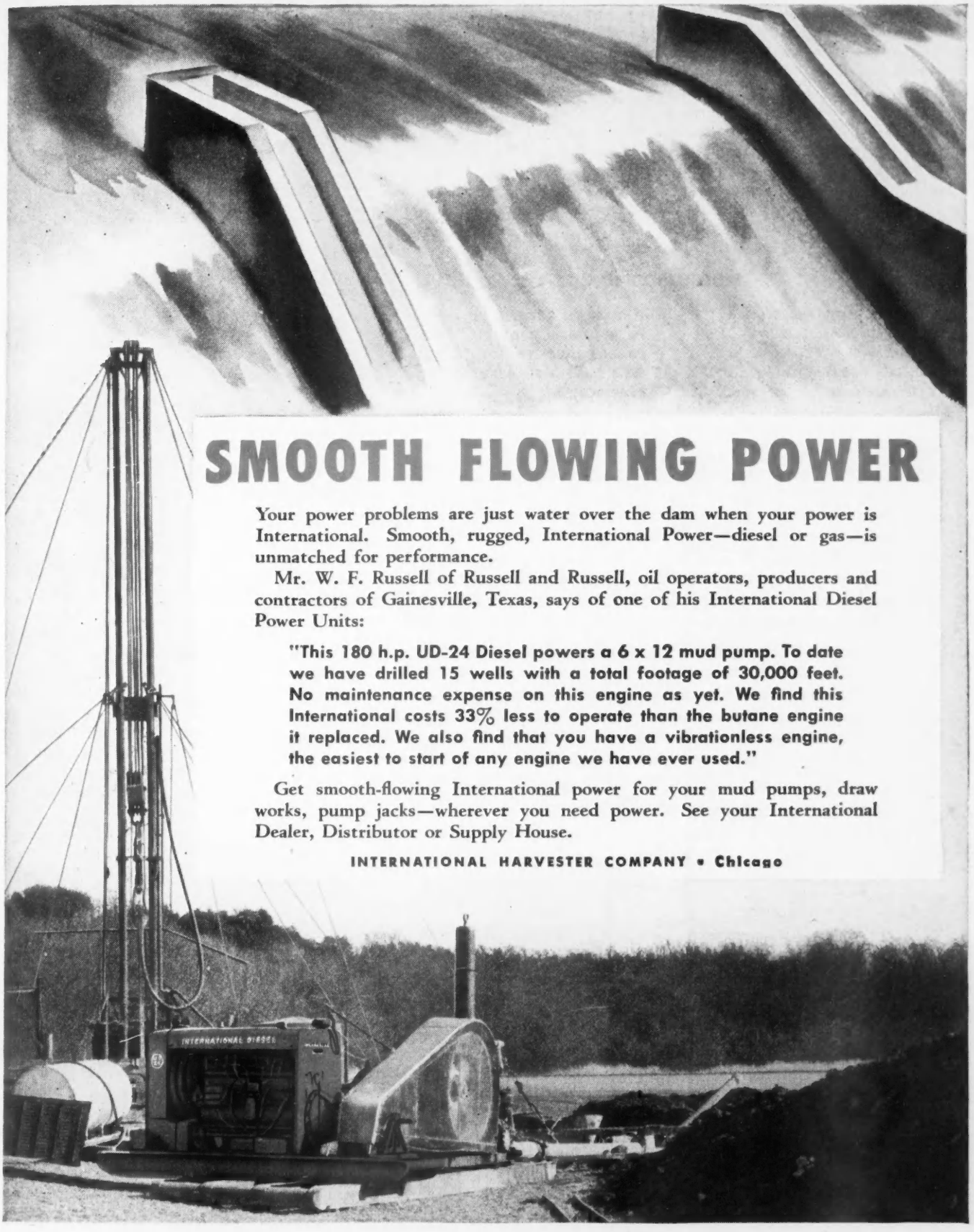
TOP RIGHT: Figure 4.

placement, which is slight near its north end, increases to about 400 feet in the vicinity of the village of Drake's Creek. Near this village the Atoka or Winslow formation has been down-faulted against the Fayetteville shale.

The best geological markers which have been found during recent drilling are the Fayetteville, Boone and St. Peter formations. The Arbuckle and pre-Cambrian rocks have not yet been penetrated but further testing in these deeper horizons should reveal good oil and gas possibilities.

The first well drilled in the area was a test for water to supply the Duncan Canning factory at the settlement of Georgetown and was in SE SW 3-15n-27w. Although water can be found in abundance at about 85 feet the well was carried to a depth of 270 feet where the tools encountered a heavy gas pocket and were blown out of the hole. Drilling was later resumed but the hole was carried to 600 feet before cuttings were saved for geological correlation. The base of the Fayetteville shale and its contact with the Mississippian Boone was established at 605 feet. The drill penetrated 47 feet of the Boone which, under fluoroscopic examination, revealed staining and small flecks of asphaltic material throughout, while the Fayetteville shale showed oil saturation. Figure 5 represents the results of the fluoroscopic survey and the chemical analysis of geological samples at corresponding depths, the fluoroscopic evaluations being presented on a percentage rather than on a quantitative recovery value. From the chemical analysis the solubility of the samples was 61.65 percent with residue composed chiefly of sand and some shale. An X-ray analysis of cutting from 646 to 653 feet showed the material was composed of 60 percent SiO_2 (alpha quartz) and 40 percent Ca CO_3 (calcite). No free oil was encountered in the test.

Following the chemical analysis an acid treatment was attempted. In preparation, 452 feet of five-inch casing was run and cemented with four sacks of cement. The treatment began with an acid wash of the bore hole before placing the solvent into the formation. A



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break down pressure of 700 pounds per square inch was recorded. Shortly afterwards two barrels of acid were pumped into the formation until circulation was established after which the treatment was halted. The well was later given a light nitro shot but it was never cleaned out and was temporarily abandoned.

On the basis of the staining in the 47 feet of the Boone a second test was started approximately 300 yards to the southwest of the Duncan well. The second well was drilled to 1105 feet and staining was again encountered in the upper 55 feet of the Boone. The well was projected to the Arbuckle at an interpolated depth of 1270 feet but a flow of fresh water encountered in the St. Peter sandstone forced a discontinuance of drilling at 1005 feet. It was during the drilling of this well that the hydrocarbon evaluation of the area was completed by radarology.

On the basis of the surveys and available well data a Texas syndicate decided to drill additional wells for the purpose of testing the possibilities in the Boone section which, as has been reported, had shown good staining, as well as to secure more accurate sub-surface data. Locations were staked on what was believed to be the high part of the structure and where the radarological survey showed the heaviest concentration of hydrocarbons. The enclosed area of the survey in Figure 2 actually represents the limits of the heaviest concentration and it is believed that additional development will tend to extend the area.

Two wells were staked simultaneously, the Howard 1, NW SW 25-15n-27w, and the Sisemore 1, SE SE 15-15n-27w, and the tests were carried to depths of 780 and 765 feet, respectively. Unfortunately the original intention of testing the Boone was not carried out, although the sections drilled in these wells were more regular and uniform than those encountered in the two Duncan wells drilled in 3-15n-27w. In the Howard 1 the Wedington sandstone was topped at 754 feet and good odor and staining was reported.

The four tests discussed in this article were drilled with light spudding equipment and considerable mechanical troubles were encountered. In the Howard well a green sloughing shale was encountered which gave considerable trouble. The writer believes that light rotary equipment is more practical and should be used in future drilling operations.

Conclusion

While none of the tests described have resulted in commercial producers, evidence of possible oil and gas concentrations in the Mississippian has been proved and the surveys made indicate evidence of structure. Very little geological data were available for Madison County prior to the inception of current activity which has had the effect of stimulating reconnaissance work not alone in Madison, but in Washington and Benton counties which are contiguous, and results prove that many local areas throughout northwest Arkansas merit closer investigation. The burden of testing the potential oil and gas possibilities in this area is being carried by a few aggressive oil operators including local businessmen who realize that success will mean a great deal in the future industrial development of the area.

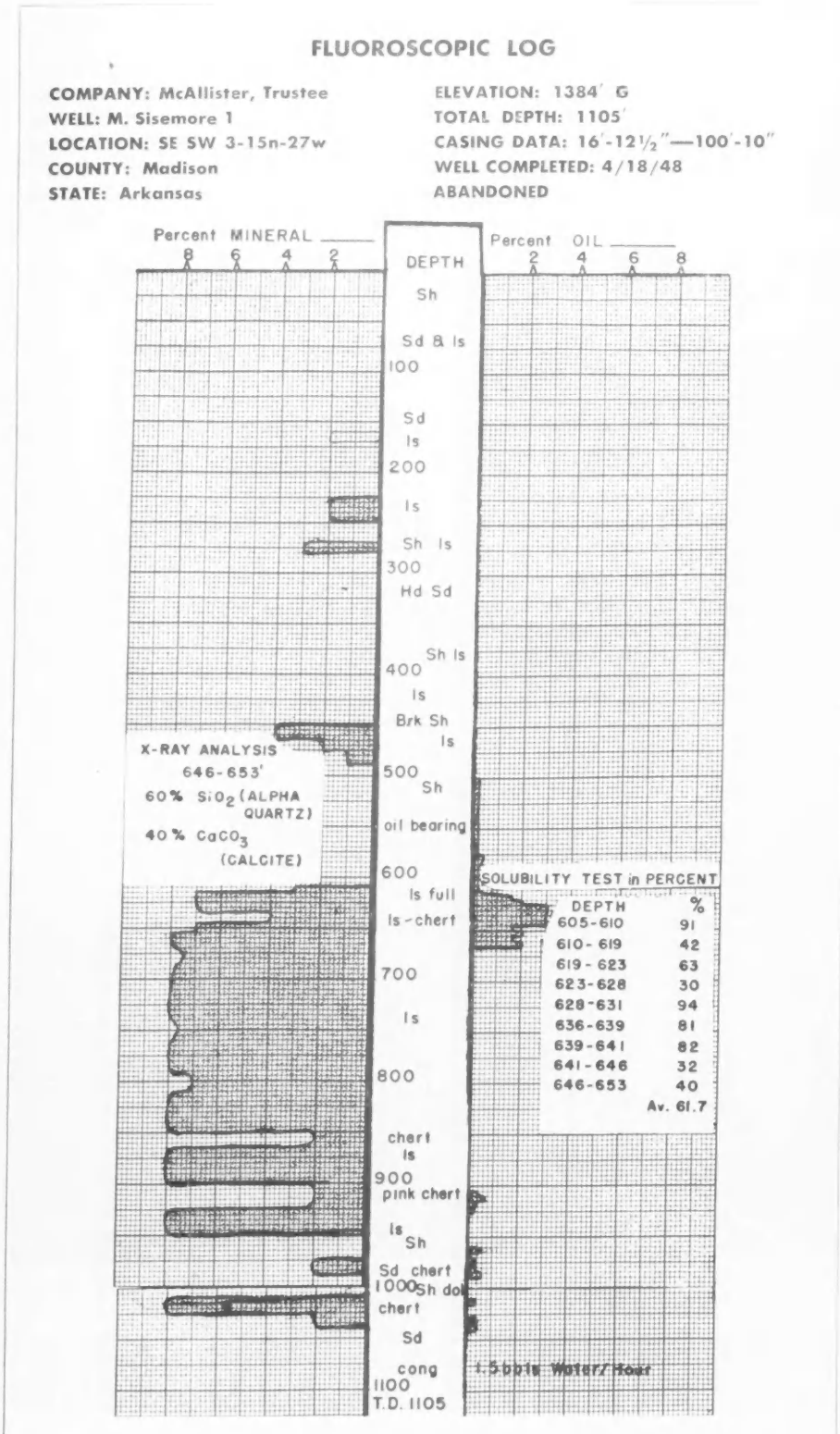


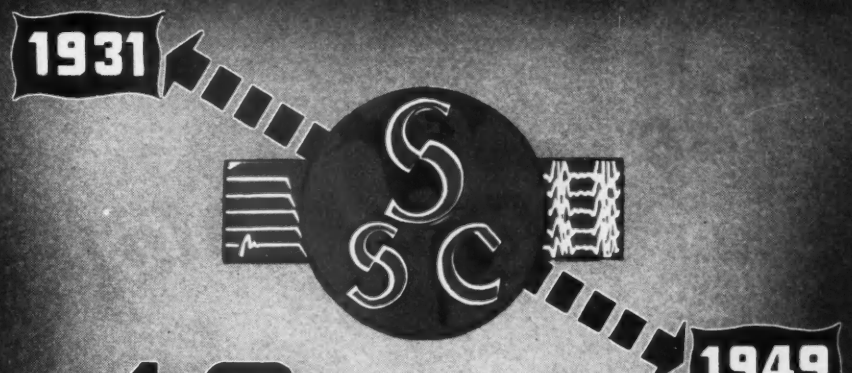
FIGURE 5

BIBLIOGRAPHY

"Geology of the Arkansas Paleozoic Area," Carey Croneis.

ACKNOWLEDGMENT

The writer acknowledges the assistance given by Jack Brant, geologist, The Atlantic Refining Company.; H. L. Scott, consulting geologist; and Dowell Incorporated for information incorporated in this article.



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Shoreline Processes Of The Continental Shelf

By PROF. OREN F. EVANS

Department of Geology, University of Oklahoma

CONSIDERATION OF the various wave, tide and current effects on the formation of the surface of the continental shelf below the level of the water leads to the development of a theory for the formation of structures or formations favorable for the accumulation of oil and to the probable formations to be penetrated by the drill bit after stepping out beyond present known areas. The author traces movements of sediments on the shelf and evaluates the effect of such work.

WITH the building of the first offshore, barge-tended, drilling platform, the equivalent of a whole new continent was opened to the oil industry.

The continental shelf has an area of about 10 million square miles. This is equal to the whole of North America, Arabia, and Venezuela with Oklahoma and Kansas thrown in again for good measure. It borders the continents almost everywhere but varies greatly in width. For example, off Newfoundland it is 240 miles wide and, though well developed along the New England coast, gradually narrows to the south until it nearly disappears at Cape Hatteras and off Palf Beach. It is moderate in width along the coast of Brazil but in the Argentine, south of Bahia Blanca, it reaches out 350 miles into the Atlantic. It is generally narrow along the west sides of both North and South America but on the opposite side of the Pacific, along the Asiatic coast, it is the widest in the world, reaching 750 to 800 miles in the Yellow Sea and in the Gulf of Siam.

600-Foot Average

The outer edge of the shelf is said to average about 600 feet in depth but, locally, it varies widely from this figure. Sometimes it slopes uniformly clear to the outer edge, as along the coast of Texas, where in some places it runs out evenly and smoothly to a width of 100 miles and a depth of 200 feet. Elsewhere, as along the coasts of New England and British Columbia, the bottom may be rugged and irregular with many deeps and shallows.

Probable Deposits

How much of the continental shelf is underlain with oil, no one knows. In general, the same laws of petroleum accumulation will probably be found to hold as on land except, perhaps, as the unconsolidated sediments may be affected by an excess of sea water. In fact, conditions prevailing on the shelf today must be very similar to those which were present in the great epeiric seas of the past when the sediments were being laid down in those great basins on the continents from which much of our oil now comes. But submarine geology is yet in its infancy. Strange as it may seem, geologists are not yet in complete agreement on what the continental shelf is or how it was formed.

Two Theories

One idea, the one usually presented in our textbooks, is that the shelf is the direct result of the work of the waves and currents and so belongs to the ocean and constitutes a part of the sea bottom. The other idea is that the continental shelf is merely the edge of the continent flooded by the sea; that, for some reason, the ocean is now too large for its basin and so overflows on the land. As to which of these ideas, if either, is correct, has not up to now worried the oil geologist. But it is going to, just as soon as prospecting on the shelf gets beyond the point of merely extending the already known oil fields, as is now being done along the Gulf Coast and the coast of California. The true answer to the shelf problem will probably be found as a result of prospecting and drilling, just as those operations have added so tremendously to our knowledge of the geology of oil producing on land.

If, according to the first idea, the continental shelf is merely a giant "cut and built" terrace caused by the waves and currents cutting into the edge of the continent and carrying the gravel, sand, and mud some distance offshore and dropping it, then, in general, in drilling near shore we will expect to reach solid rock like that of the nearby coast rather quickly. And with increasing distance from shore, we will expect

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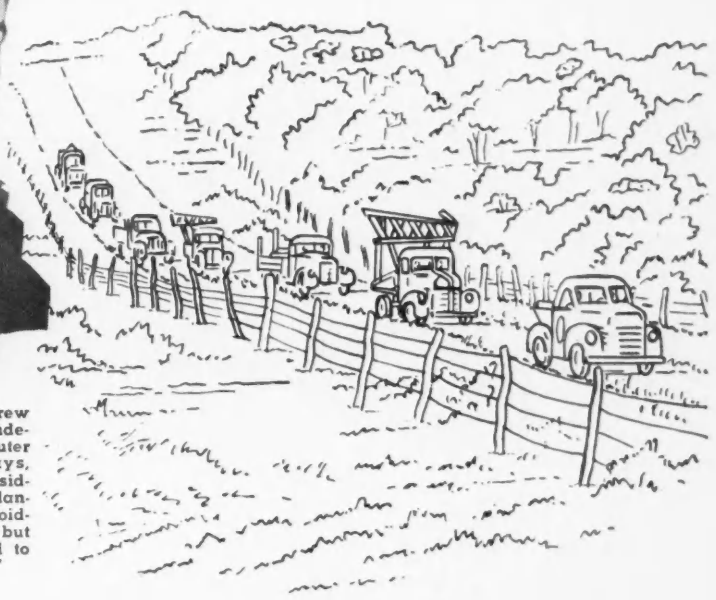

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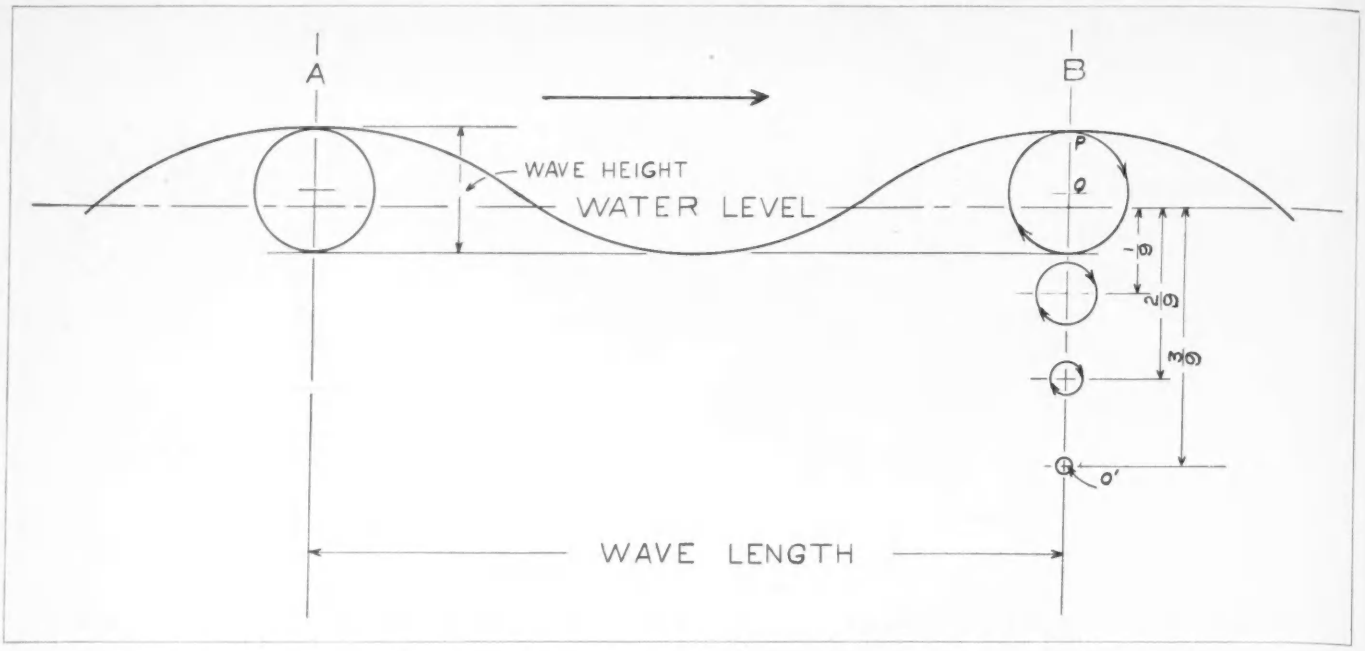


FIGURE 1. While the wave has traveled a distance equal to A-B, water particle "p" has moved through the circular path whose center is at "o". At the same time, every other particle of water in the wave has moved through a similar orbit. This circular movement dies out rapidly below, decreasing by one-half with every increase in depth of one-ninth the wave length. It ceases entirely at a depth equal to the length of the wave. The circle at "o' " shows the relative movement of the particles at three-ninths the wave length beneath the surface. This explains the rapid falling off of wave disturbance with depth.

to find an increasing fineness of sediment along with a gradual thickening of recent unconsolidated sediments which become more consolidated at considerable depths. But if the shelf is just the flooded edge of the continent, the general geology will be found to be much like that of the adjacent land, the sediments varying irregularly in depth and is likely to be coarser as to be finer with distance from shore. But, of course, if a coast is either rising or sinking, there will be complications.

A sinking shore that has been receiving a heavy load of sediment from the land for several thousand years, as appears to be the case along the Texas coast, will have a thick layer of unconsolidated material relatively near shore. But if the shore is rising as it is now along the coast of California, then only a thin veneer of loose material will be found until well out toward the edge of the shelf. Of course, in either case, relatively thick deposits of unconsolidated sediments are to be expected near the mouths of rivers, or in any folded or faulted basins that may be present on the shelf. But geologists and engineers are concerned not only with conditions below the shelf surface, they must know also what is taking place on it at the present time.

An Area of Constant Adjustment

The continental shelf, whatever its origin, is an area of constant adjustment and transportation of sediments. The chief agents causing these movements are the winds, the waves, the tides, and gravity. The winds, through friction, drag the surface water along with them, often piling it up on one side of a lake or bay and drawing it down on the other. With only a moderate wind, the windward and leeward sides of a small lake will show a difference in elevation of several inches. During the great "Armistice Day storm" of about ten years ago, the difference in height of water between the east and west sides of Lake Michigan was 12 to 14 feet. Such piling up of water on a lee shore sets up very strong outward moving currents.

Through the zone of breakers this offshore flow of water is taken care of by strong localized currents that move outward against the waves with velocities of two or three miles an hour. These are called rip currents. Out beyond the breaker zone and well beneath the surface is an outward moving current, or undertow, that, during storms, is fairly strong.

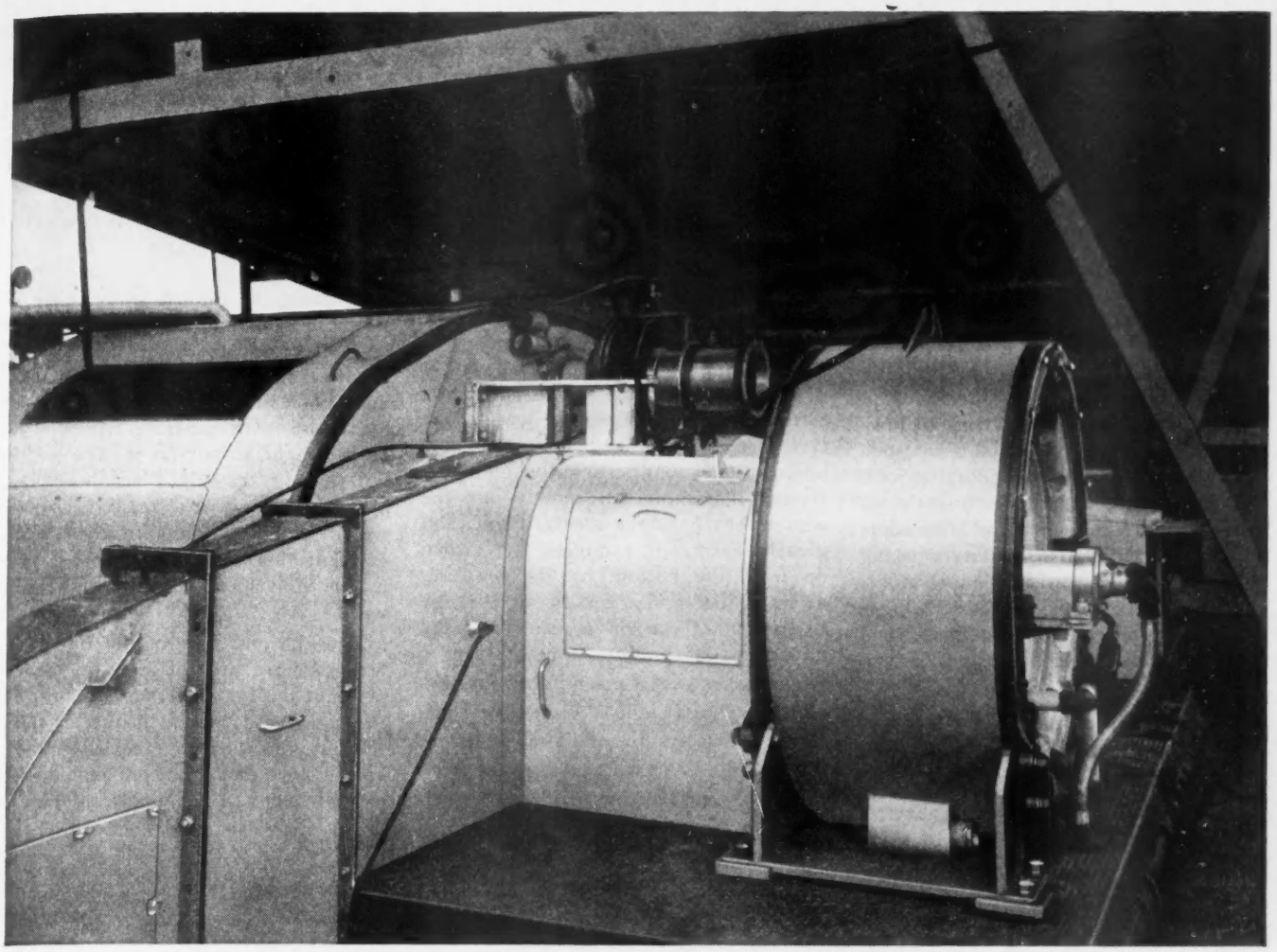
CORRECTION

Due to an oversight, the article "Flow Properties of Drilling Mud," by T. H. Dunn, W. F. Nuss and R. W. Beck, which appeared in WORLD OIL for February 1, was printed without the acknowledgment of prior presentation, which occurred at the 1947 Southwestern District Meeting of the API.

Wave Action

Also, the winds are the chief cause of the water waves. Tidal waves, caused by earthquake shocks, occur occasionally but are so rare that their long range effect on the bottom is negligible. In ordinary water waves of oscillation (see Figure 1), the particles of water within the wave move in a circular path whose diameter is equal to the height of the wave. This circular movement decreases downward rapidly until it dies out completely at a depth equal to the length of the wave. In waves of this kind, there is a slight forward drift, due to the internal structure that, in addition to the surface drag, helps the wind in piling the water onshore. Oscillation waves also cause alternating movements on the bottom that, in sandy deposits, result in the formation of ripple marks. Many of theses are symmetrical in form and stationary, but, in the zone of breakers, some are asymmetrical and the sand in them moves slowly forward in the direction of wave travel. They are important in the shoreward movement of sediments as will be explained later. When waves of oscillation enter shallow water and break, they often set up waves of translation in which the water moves bodily forward and does not return. Thus they carry shoreward, either on the bottom or in suspension, any material that is small enough to be moved.

A third transporting agent is the



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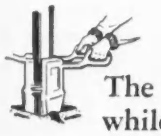

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tide. Though the tide has the nature of a long wave, its chief importance in water movements on the shelf is the changes it brings about in water levels near the shore. In some places, as in the Bay of Fundy, spring tides pile up the water to a depth of 40 or 50 feet, causing powerful hydraulic currents. In some of the passes along the British Columbia coast, tidal currents up to eight or ten miles per hour are common.

Gravity is, of course, an accompanying agent in the production of all hydraulic currents as well as in all those currents resulting from differences in salinity or temperature. Strong salinity currents are always present in such places as the Straits of Gibraltar and Bab-el-Mandeb, and at the mouths of many large rivers such as the Mississippi and the Amazon. Also, gravity working alone, sometimes causes sediment movements on such steep slopes as sometimes form at the outer edge of deltas and at the heads of submarine canyons.

Movements of Sediment Away From Shore

Though the migration of the sediments on the shelf is very complicated, in the long run the sum total of these movements is offshore. There is a constant loss of material from the land to the adjoining water bodies. This sediment load moves over the shelf in traction and in suspension in much the same way a load is carried by a stream. However, within the breaker zone, suspension is relatively more important than in a stream because breaking waves are more effective in throwing the sediment into suspension than is the turbulence set up by the water flowing over a stream bottom.

Both in traction and suspension, tidal currents and rip currents are effective in moving the material away from shore. Within the breaker zone, they are probably the two most important agents. Outside the breaker zone the offshore transportation is taken over by the undertow as well as by certain bottom currents, the origin of which is not well understood, though they are believed to be largely the result of tides, temperature differences, and density currents resulting from differences in amount of fine mud in suspension.

Most of the time the undertow is too slow in its movement to erode the bottom very much, but it is important in moving the finer sediments in suspension out to deeper water. All these processes are most effective during heavy storms with the winds onshore and it is at such times, rather than in periods of medium or gentle winds, that by far the greater amount of offshore transportation of sediment occurs. During heavy storms, the water eats rapidly into the shores, beach ridges are torn out, and great quantities of sediment are thrown up from the bottom by the breaking waves to be carried out to sea through the action of the rip currents and the undertow. The writer was told by a Great Lakes vessel master that for several days after the "Armistice Day" storm the waters of Lake Michigan were discolored half way across the lake from the east side. And commercial fishermen say that after every heavy storm their nets, even if set in deep water several miles from shore, come up entangled with roots, grasses, and other debris though at other times there is very little of this.

Movements of Sediment Toward Shore

Oscillation waves within the breaker zone have been thought by some investigators to be an agent in moving the finer sediments away from shore and the coarser sediments toward shore at the same time. Waves that are symmetrical in cross-section set up a series of alternating movements on the bottom that are short and quick toward shore but longer and slower away from it. Since the size of the particles moved by a current varies approximately as the sixth power of its velocity, it has been argued that the smaller particles are moved offshore in the longer, slower current at the same time the larger particles are carried toward the shore in the shorter, swifter movement.

Reverse Undertow

Another factor in the movement of sediment toward shore is the reverse undertow. This is a sub-surface current that moves in toward shore when the winds are offshore. On the whole, it is less important than the undertow because, coming in from deep water, it does not contain much suspended sediment and with offshore winds, waves large enough to stir up the bottom cannot form. It is only when swells from a distance come in against the offshore winds strongly enough to cause breakers that this current is of much effect in the movement of sediments shoreward.

The ebb and flow of the tide should give onshore and offshore movements of about the same average strength. But the shoreward current is the less effective, on the whole, since it is moving up the slope of the bottom against gravity. However, if the incoming tide deposits material above the low water mark it is likely to remain as the water comes to rest, and then slowly withdraws. This action is often important in the filling of tidewater swamps.

Two other important, but less well known factors, in the landward transportation of sediment are the shoreward movement of sub-aqueous dunes and of asymmetrical ripple marks. During heavy storms the waves sometimes rush sand from shore out into the breaker zone. Often this is of such great quantity that the waves are unable to keep it in suspension and it drops to the bottom. Usually this sand takes the form of a ridge extending out beneath the water more or less parallel to the shore. After the storm, the water above these ridges is usually so shallow that the ordinary waves of oscillation resulting

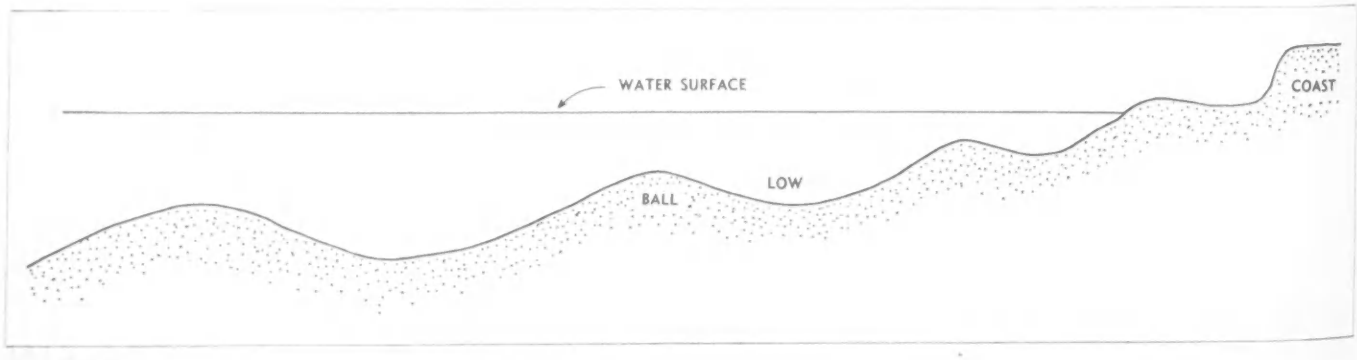

FIGURE 2. The number of balls that form depends mostly on the slope of the bottom. The less the slope, the greater the number of troughs and ridges. On Chesapeake Bay, which is very shallow, as many as ten in 650 feet have been observed. (Vertical scale magnified ten times.)

from moderate winds break against them and, in doing so, are changed to waves of translation. These move so rapidly shoreward across the top of the submerged ridge that large quantities of sand are swept to leeward and deposited on the shoreward side of the ridge, building it up to the angle of repose of sand under water. As more material continues to move across the top of the ridge and slide down the slope, a forward migration of the ridge occurs.

Along the shores of the Great Lakes, such ridges vary from two or three inches up to as many feet in height and are form 10 to 30 times as wide as they are high. Such traveling masses of sand bury everything on the bottom just as do traveling sand dunes on land. In this way, ripple marks or other patterns on the bottom are preserved. Also the sand, as it moves down the lee slope, takes on a cross laminated pattern. Probably much of the cross-bedding in such formations as the Dakota sandstone has been produced in this way.

Of course, if the conditions are such that no further material is added to the windward side of the ridge its height is gradually lowered as it spreads out to leeward toward shore. But this seldom happens because of the sediment thrown into suspension by the waves breaking against the windward side of the ridge. In a breaking wave, the circular movement tends to throw the sediment to windward as it comes off the bottom, but on the outer edge of a shallow ridge the forward drift caused by the waves and the rapid forward movement in the wave of translation combine to carry much of the suspended sediment to the top of the ridge. Added to this is the forward movement of the sediment on the bottom in the migrating ripples as they move up the windward side of the ridge.

"Low and Ball"

A type of underwater form that can easily be mistaken for migrating subaqueous dunes is the structure known as "low and ball" (Figure 2). It is found offshore on sandy, gently sloping bottoms like those along the shores of the Chesapeake, the Gulf of Mexico, or the eastern shore of Lake Michigan. It is made up of a series of troughs and ridges running parallel with the shore. In Lake Michigan there are usually from one to three of these. The innermost one is about 200 feet from shore, the second about 600 feet, and the third between 1100 and 1200 feet. The ridges get larger with distance from shore. In Lake Michigan, the one nearest shore lies with its crest about four feet beneath the surface and rises about two feet above the bottom with a width of around 100 feet. The top of the outermost one is usually about 12 feet below the water surface and rises about six feet above the bottom with a width of about 250 feet. However, the size and spacing of the troughs and ridges of the low and ball vary considerably from locality to locality. It is controlled by the slope of the bottom, the size of the waves, and, probably to some extent, by the character of the sediments. In Chesapeake Bay, where the water is shallower and the bottom slopes more gently than in Lake Michigan, the lows and balls are smaller and closer together. As many as ten in a distance of 650 feet have been counted. A study of those in Lake Michigan, which was made by the writer some years ago, shows that they are formed at the breaker line during storms and remain fixed in position as long as the depth of water in which they form does not change. On a rising coast they are destroyed by the waves as the water becomes shallow, and are never preserved, but on a sinking coast they are buried under the incoming sediments. If encountered in drilling, they would appear much like a buried spit or bar.

Rippling Agent

On the outer sides and across the tops of these balls and of sub-aqueous dunes, as well as nearly everywhere else within the breaker zone, asymmetrical wave-formed ripples are an important agent in the shoreward transportation of sediment. As before explained, they are caused by unequal movements set up on the bottom by deformed waves of oscillation. They move over the bottom in the direction of their steeper slope. With a wave of given size, the deeper the water, the smaller the ripples that are formed. Their rate of forward travel depends mostly on the size and strength of the waves and the slope of the bottom. In moderate winds they usually move a distance equal to the interval between crests of the ripples in anywhere from five minutes to half an hour.

Though asymmetrical ripples are an important factor in moving sediment shoreward, it is difficult to determine just how much work they do. The material in them is moved forward in the stronger of the two surges that occur as a wave passes over, but the current set up is often strong enough so some of the finer material is lifted and carried backward by the following weaker offshore movement. That this results in an actual separation of the sediment with a shoreward movement of the coarser grains and an offshore movement of the finer ones, as some theorists have argued, seems doubtful. But it does cause some of the finer material to be carried more than once over the same ground and thus reduces the total amount moved forward in a given time.

Thus it is evident that the movements of the sediment on the continental shelf are extremely complex. It is generally conceded that the total movement of material away from shore is greater than that toward shore. Some islands have been greatly reduced in area by wave and current action, and a few have entirely disappeared beneath the waves. But it is still an open question among geologists whether or not, with the lapse of sufficient time, a whole continent could thus be destroyed. Perhaps within the next half century the drillers and oil geologists will have collected enough information through their explorations of the continental shelf to give us the answer.

About the Author

PROF. OREN F. EVANS of the University of Oklahoma has devoted many years in research work on marine sedimentation and shore processes. The oil industry's expanding activities and interest in the continental shelf make this work of paramount importance today. He was born at Shelby, Mich., and received a bachelor's degree from Albion College and his master's and doctor's degrees from the University of Michigan. He taught mathematics and physics in Albion College for two years and went to the University of Oklahoma in 1920. Since retirement last year he has been retained on half time for research and to teach a course for graduate students on the subject of shorelines and shore processes. He has published numerous articles on the subject in the *Journal of Geology, Journal of Sedimentary Petrology, Science, American Journal of Science,* the *Scientific Monthly* and other publications.

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Record Well Drilling Slowly Below 19,798 Feet

THE world's deepest well, the Superior Oil Company's Pacific Creek Unit 1, in Sublette County, Wyoming, was still several hundred feet short of the 20,000-foot mark in the last week of May, but was drilling ahead below 19,798 feet.

Drilling did not progress as much in the past month as it had previously as only about 400 feet were made and a month ago the drilling rate was from 40 to 45 feet per day. The constantly increasing threat of twisting off the drill pipe and resulting costly fishing jobs has played a big part in the slowed rate of penetration.

Another big factor was the running of casing. It was reported unofficially that about 19,500 feet of seven-inch casing was cemented and that an electric log and formation tester had been run. Rumors continue to circulate concerning shows and saturated sands, but the well is strictly a tight hole and little information has been released by Superior. To date, drilling depths have been given, but nothing on the well's geology has been released.

Summary of Results of Exploratory Drilling

ITEM	April, 1949	March, 1949	FOUR MONTHS January-April 1949	1948	Percent Diff.
Oil Discoveries	93	93	309	258	+ 19.8
New Fields	58	69	213	151	+ 41.1
New Pays	35	24	96	107	— 10.3
Distillate Discoveries	15	12	48	29	+ 65.5
New Fields	8	5	25	11	+127.3
New Pays	7	7	23	18	+ 27.8
Gas Discoveries	15	14	46	42	+ 9.5
New Fields	11	14	37	27	+ 37.0
New Pays	4	.....	9	15	— 40.0
Total Discoveries	123	119	403	329	+ 22.5
Extensions to Fields	27	30	87	57	+ 52.6
Oil Fields	22	26	78	44	+ 77.3
Distillate Fields	2	3	5	6	— 16.7
Gas Fields	3	1	4	7	— 42.9
Total Prod. Tests	150	149	490	386	+ 26.9
Dry Holes	477	497	1729	1497	+ 15.5
Wildcats	477	486	1711	1470	+ 16.4
New Pays	.....	2	2	5	— 60.0
Outposts	.....	9	16	22	— 27.3
Total Expl'tory Tests	627	646	2219	1883	+ 17.8
Percent Productive	23.9	23.1	22.1	20.5	.....
Percent Dry	76.1	76.9	77.9	79.5	.....

See Tables on Pages 88-90-92

Results of Exploratory Drilling in April and First 4 Months, 1949-1948, by Districts

State or District	MONTH OF APRIL, 1949													FIRST FOUR MONTHS, 1949																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests									Total Productive	Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions							4 Mo.	4 Mo.	4 Mo.	4 Mo.
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	4 Mo. 1949	4 Mo. 1948	Wildcats	New Pays	Outposts	1949	1948	1949	1948
Alabama											4			4												6			6	4	6	4
Arisona																										3			3		3	
Arkansas	1			1						2	4			6	2			2						4	2	14			14	27	18	29
California	1						2			3	34			37	4		1	3			8		1	17	11	79		1	80	70	97	81
Colorado											2			2												8			8	18	8	18
Florida											1			1												7			7	5	7	5
Georgia											1			1												3			3	2	3	2
Illinois	1			2			5			8	30			38	2			7			16			25	23	123			123	120	148	143
Indiana							1			1	14			15	11			2			1			14	8	119			119	52	133	60
Iowa																																
Kansas	6			1			1			8	29			37	20		2	1			3			26	24	112			112	125	138	149
Kentucky	1									1	3			4	2									2	3	10			10	10	12	13
Louisiana	2		1	2	3		1			9	21			30	12	2	3	8	11		4			40	28	63			63	70	103	98
North Lousiana					2					2	11			13	3	1	1		6					11	5	31			31	33	42	38
South Louisiana	2		1	2	1		1			7	10			17	9	1	2	8	5		4			29	23	32			32	37	61	60
Maryland																														1		1
Michigan							1			1	31			32	6		1				4			11	7	113		1	114	72	125	79
Mississippi	1									1	11			12	2			1						3	1	34			34	27	37	28
Missouri											1			1												1			1		1	
Montana	1									1	1			2	1									1	2	7			7	11	8	13
Nebraska																																
Nevada																																
New Mexico	2									2	4			6	3			2						5	9	14			14	22	19	31
New York																																
North Carolina																																
Ohio									1	1	1			2							2		1	3	7	14			14	13	17	20
Oklahoma	6			3	1		3			13	43			56	14	2	1	7	1	1	9			35	36	144			144	146	179	182
Oregon																																
Pennsylvania			1							1				1			1							1		1			1	2	2	2
South Dakota																														1		1
Tennessee															1									1		5			5	9	6	9
Texas	35	8	8	24	3	4	8	2	2	94	230	.....	.....	324	129	21	24	58	11	8	27	5	2	285	210	789	2	11	802	668	1087	878
Dist. 1 S. Central	2									2	20			22	7						1			8	3	86			86	60	94	63
Dist. 2 Middle Gulf		3	1	3	1	1	1	1		11	15			26	3	8	5	4	1	2	1	1		25	27	53		3	56	70	81	97
Dist. 3 Upper Gulf	1	2	1	5	2	2				13	18			31	7	6	1	17	4	2	3	2		42	30	88			88	82	130	112
Dist. 4 L. Gulf-SW	1	3	2	10		1		1		18	24			42	4	5	6	18	4	4		1		42	33	128	1	4	133	108	175	141
Dist. 5 E. Central											14			14		1						1		2	5	28			28	22	30	27
Dist. 6 Northeast	1		1						1	3	6			9	3	1	2		2				1	9	9	17			17	28	26	37
Dist. 7-B N. Central	11		2	4						17	52			69	47			9	8		1			65	45	173	1		174	110	239	155
Dist. 7-C W. Central	4						1			5	9			14	7				1		1			9	7	18			18	27	27	34
Dist. 8 West	8						4		1	13	22			35	16				3		14		1	34	23	54		2	56	55	90	78
Dist. 9 North	7		1	2			2			12	50			62	34		1	7			6			48	28	143		2	145	104	193	132
Dist. 10 Panhandle															1									1		1			1	2	2	2
Utah																					1			1		5			5	8	6	8
Virginia																									1							1
Washington																														1		1
West Virginia			1							1	1			2			4							4	2	1			1		5	2
Wyoming	1			2						3	11			14	4			5			3			12	12	36		3	39	13	51	25
Total U.S.	58	8	11	35	7	4	22	2	3	150	477	.....	.....	627	213	25	37	96	23	9	78	5	4	490	387	1711	2	16	1729	1497	2219	1883

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in April, 1949

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Grav. ity of Oil
		ARKANSAS—New Oil Field						
Union	Loutre Creek	Macmillan Pet Corp & Zach Brooks Drlg Co et al's Cleg Nash et al 1, c se nw 35-18s-15w, 6 mi s & 2 mi e of El Dorado	4-15-49	8010	7761- 7777	Smackover li; Jur	F 144; $\frac{5}{12}$"	41
		ARKANSAS—New Oil Pay						
Ouachita	Stephens	Zach Brooks Drlg Co & C. G. Davis' S. J. Hamilton 1, c nw sw ne 19-15s-19w.	4-16-49	3401	3243- 3253	Hogg sd; L Cre	F 432; ¼"	33.6
		CALIFORNIA—New Oil Field						
Kern	Dyer Creek	W. R. Gerard's Gerard-Cairns 1, 730 n 1320 w fr sec of 11-26s-27e	3-29-49	2305	2285- 2305	Vedder sd; Mio	P 120	16.2
		CALIFORNIA—Oil Field Extensions						
Kern	Tejon Hills	Rainbow Oil Co's Rainbow 4, Sect 11-12n-18w, ½ mi ne extension	4- 8-49	678	620- 668	Sta. Margarita sd; Mio	P 70	28
Los Angeles	Montebello	Atlantic Oil Co's Alvitre 4, Sect 6-2s-11w, ne extension	4- 8-49	3635	3021- 3635		P 7; 28 wtr	
		ILLINOIS—New Oil Field						
Wayne	Merriam	Robinson & Puckett's J. C. Meyers 1, nw nw se 3-2s-8e, 1½ mi se Fairfield, E pl.	4-26-49	3377	3368- 3373	McClosky li; Miss	P 46	
		ILLINOIS—New Oil Pays						
Edwards	Grayville, W.	W. Duncans & Yingling's Schmittler 1, sw sw se 14-3s-10e, ½ mi n of prod.	4-12-49	3206	2382- 2392	Waltersburg sd; Miss	P 30	
White	Grayville, W.	C. E. Brehm's Hon 4, se sw ne 34-3s-10e	4- 5-49	2875	2455- 2466	Tar Springs sd; Miss	P 300	
		ILLINOIS—Oil Field Extensions						
Madison	Livingston	O. R. Shull's Hunecke 1, sw sw nw 17-16n-6w, ½ mi n extension	4- 5-49	565	557- 565	Pennsylvania sd	P 10; 5 wtr	
Richland	Clay City-Noble Cons.	Louis Jordan et al's Levitt 1, sw nw ne 22-3n-9e, 1 mi e extension	5- 3-49	3020	3009- 3018	Rosiclare li; Miss	P 45	
Richland	Olney, S.	Don Baines' Charles Schonert 1, se se nw 16-3n-10e, 1¾ mi e extension	4-19-49	3158	3182- 3194	Rosiclare li; Miss	P 20; 30 wtr	
Wabash	Maud, N.	R. H. Osgoodby's J. W. Sterl et al 1, nw nw nw 22-1s-13w, ¾ mi e extension	4-26-49	2534	2523- 2533	Bethel sd; Miss	P 22; 10 wtr	
Wabash	NewHarmony-Keensburg Cons.	Gallagher & Aurora Gasoline Co's Richardson 1, ne ne se 35-2s-14w, 1 mi extension.	4-26-49	2937	2524- 2537	Cypress sd; Miss	P 160	
		INDIANA—Oil Field Extension						
Posey	Griffin	Cherry, Kidd & Sloan's Mary Glaze Estate 2, c nw nw nw 11-4s-14w, 1 mi sw extension.	3-16-49	3034	2228- 2241	Tar Springs sd; Miss	P 38	
		KANSAS—New Oil Fields						
Barton	Bryant, SE.	W. H. Black & Gough Davis' Panning 1, sw sw se 26-20s-12w, ½ mi se Bryant pl.	4- 5-49	3376	3269- 3277	Arbuckle li; Ord	P 510	
Butler	Butwick	J. P. Gaty's DeMoss 1, nw sw sw 7-26s-3e, 1½ mi e Greenwich pl.	4-12-49	2865	2815- 2865	Mississippi li; Miss	F 3000	
Butler	Butwick, NE.	Penguin Pet Inc et al's Holder 1, sw nw ne 7-26s-3e, ¾ mi ne Butwick pl.	4- 5-49	2854	2803- 2854	Mississippi li; Miss	P 50; 10 wtr	
Butler	Whitewater	E. H. Adair's McCullough 1, se se nw 32-25-8e, 1 mi n Towanda pl.	4-12-49	2655	2645- 2655	Viola li; Ord	P 50	39
Rooks		Continental Oil Co's Yohe 1, se se ne 4-9s-18w, 1½ mi s Hobart pl.	4-19-49	3511	3266- 3290	Lansing-K.C. li; Penn	P 892	
Stafford	Moon	E. H. Adair's Moon 1, nw nw se 4-22s-13w, ¾ mi se Hufford pl.	4-26-49	3802	3500- 3508	Lansing-K.C. li; Penn	P 30; 67 wtr	34
		KANSAS—Oil Field Extension						
Ellis	Catherine	Darby & Bothwell's Giebler 1-B, ne ne se 10-13s-17w, ½ mi s&e extension.	4-15-49	3542	3324- 3334	Arbuckle li; Ord	P 432	27.5
		KANSAS—New Gas Field						
Stafford	Hildebrand	Delta Prod Co & B and R Drlg Co's Hildebrand 1, nw nw se 2-24s-12w, 1 mi n Stafford pl.	4-26-49	3985	3792- 3800	Viola li; Ord	F 2 mln	
		KENTUCKY—New Oil Field						
Daviess	Waitman	C. E. Skiles' R. F. Kelly 1, se sw ne 8-Q-31, 3 mi e Nantz pl.	4-15-49	1317	1312- 1316	McClosky li; U Miss	P 112	
		NORTH LOUISIANA— New Distillate Pays						
Caliborne	Athens	Skelly Oil Co & Sunray Oil Co's H. D. Butler 1, 1839 fr sl 2121 fr wl of 36-20n-7w.	4- 7-49	6531	5210- 5249	Gloyd li; L Cre	F 42; 5 mln; $\frac{3}{8}$"	51
Lincoln	Hico-Knowles	The California's Co's W. V. McFearin Unit V-7, Sect 22-20n-4w	4-13-49	9150	8908- 8920	McFearin sd; Jur	F 265; 2.5 mln; $\frac{5}{8}$"	56.4
		SOUTH LOUISIANA—New Oil Fields						
Cameron	Mallard Bay	The Martex Realization Corp's A. E. White 1, 330 e 1700 s of nwc of 14-13s-3w, 5½ mi e Grand Lake fld.	4-24-49	10642	6715- 6744		F 160	39.7
Lafourche	Lake Raccourci	Humble O&R Co's State Lse 1452-1, in Lake Raccourci mid-way betw Leeville & Lake Barre flds.	4-13-49	14650	9841- 9844		F 455; $\frac{5}{32}$"	50.2
		SOUTH LOUISIANA—New Oil Pays						
Terrebonne	Block 32	Kerr-McGee Oil Industries, Inc's State Lse 755-1, Blk 33, Gulf of Mexico	4- 2-49	3344	2663- 2678		F 312; ¼"	29
Terrebonne	Four Isle Dome	Superior Oil Co's LL&E-State Unit 12-5, 372.69 n 540 e of swc of Unit 12 in 24-21s-16e.	4-27-49	11827	11140-11152		F 327; $\frac{5}{64}$"	34
		SOUTH LOUISIANA—Oil Field Extension						
Vermilion	Tigre Lagoon	Union Oil Co of Calif's Eraste Thibodeaux 1, Sect 42-13s-5e, 1 mine exten-	4-18-49	11784	10470-10475	Miocene	F 260; $\frac{7}{64}$"	52.3
		SOUTH LOUISIANA—New Distillate Pay						
Terrebonne	Four Isle Dome	Superior Oil Co's LL&E-State Unit 14-3, 139.18 s 374.75 e of nwc of 23-21s-16e.	4-21-49	14564	12452-12468		F 197; 6.5 mln; $\frac{3}{64}$"	47.7
		SOUTH LOUISIANA—New Gas Field						
Plaquemines		Humble O&R Co's Pelican Island State Lse Acct. 1-1, 11,414.1 n 3312.5 e of swc Tract 1202, Blk 30 of West Delta Area, 8 mi in Gulf of Mexico.	4- 8-49	7500	2169- 2183		F 28.2 mln; $\frac{1}{16}$"	
		MICHIGAN—Oil Field Extension						
Gladwin	Beaverton, S.	Leonard Oil, Inc's Gethek 1, ne ne se 35-17n-2w, ½ mi s extension	4-22-49	3900	3846- 3872	Dundee li; Dev.	F 240	
		MISSISSIPPI—New Oil Field						
Greene	Sand Hill	Humble O&R Co's F. J. Hubbard et al 1, 565 fr el 560 fr nl of swc of 3-4n-8w, 4 mi nw of Bothwell.	4-26-49	8503	7804- 7812	L. Tuscaloosa sd; U Cre	P 46	24.6
		MONTANA—New Oil Field						
Musselshell	Melstone, NW	Amerada Pet Co's Northern Pacific 1, ne ne ne 21-10n-29e, 2 mi nw Melstone fld.	4-20-49	4428	4271- 4293	Basal Amsden sd; Penn	F 87; ¾"	31.6
		NEW MEXICO—New Oil Fields						
Lea		J. C. Clower's State 2, 1980 fr sl 990 fr el of 16-21s-34e	4-20-49	3945	3928- 3945	Yates sd; Perm	Sw 50	32
Lea		G. H. Vaughn's Phillips-State 1-16, 660 fr s&wl of 16-17s-33e, 1¼ mi n Maljamar fld.	4-21-49	4574	4340- 4430	Grayburg li; Perm	F 43; $\frac{12}{64}$"	36
		OHIO—Gas Field Extension						
Tuscarawas	Cambridge	Wasson & Co's G. H. Hunt 1, Lot 33, Washington Twp, 4 mi w town of Gilmore.	4- 5-49	3331	934- 948 3316- 3318	Berea sd; Miss Oriskany sd; Dev	F 0.6 mln F 0.2 mln	
		OKLAHOMA—New Oil Fields						
Hughes	Benjamin	J. A. Champan's McKan 1, ne se ne 14-8n-8e, e of Wewoka, ne fld.	4-14-49	3314	3303- 3312	Cromwell sd; Penn	F 20; ½"	
Lincoln	Chandler, E.	Dick Wegener's Logan 1, nw se se 10-14n-4e, 1¾ mi e Chandler pl.	4-14-49	3877	3867- 3872	Prue sd; Penn	P 60; 10 wtr	
Okfuskee	Morse, NW.	Portable Drlg Co's Harge 1, nw se ne 31-13n-10e	4-21-49	2911	2884- 2896	Gilcrease sd; Penn	F 15; $\frac{12}{64}$"	
Payne	Yale, SW.	Thomas N. Berry Co's O'Keefe 1, nw se nw 26-19n-5e	4-21-49	2816	2804- 2815	Peru sd; Penn	P 20	
Stephens		Davon Oil Co's Rue 1, (OWDD), nw sw ne 22-1s-4w, 1 mi se Alma, N fld	4-12-49	3592	3540- 3574	Hoxbar sd; Penn	F 71; 1"	34
Stephens	Palacine, S.	J. E. Jackson & Lario Oil Co's Hughes 1, sw se se 16-2s-6w.	3-22-49	2893	2686- 2694	Pennsylvania sd; Penn	P 52	38
		OKLAHOMA—New Oil Pays						
Carter	Camp	Continental Oil Co's Dotson-Snow 1, sw ne ne 7-2s-3w	4-14-49	6985	3740- 3790	Pennsylvania sd; Penn	F 41; $\frac{12}{32}$"	26
Grady	Bradley, NE.	Gulf Oil Corp's el al's Mainka 1, (OWDD), nw nw ne 12-5n-5w	4-28-49	14013	12855-12985 13031-13068 13137-13611	Bromide sd; Ord Tulip Creek sd; Ord. McLish sd; Ord	.... F 1068; $\frac{12}{64}$"	.... 46.6
Hughes	Calvin	Deardorf Oil Co's Joanne 1, se ne nw 8-5n-10e	4-22-49	5667	5588- 5610	Viola li; Ord	F 100; 80 wtr	
		OKLAHOMA—Oil Field Extensions						
Beckham	Elk City	Shell Oil Co's Kelly 1, c ne sw 23-10n-21w, 1 mi s extension	4- 7-49	10600	10100-10190	Granite wash; Penn	F 251; $\frac{5}{32}$"	55
Okfuskee	Castle, E.	Amerada Pet Corp's Pyles 3, ne ne sw 22-12n-9e, east extension	4-10-49	3937	3335- 3352	Cromwell sd; Penn	F 150	
Okfuskee	Weleetka, S.	W. A. Fleming's James 2, ne se se 8-10n-11e, nw extension	4-28-49	2641	2478- 2493	U Gilcrease sd; Penn	P 12	41
		OKLAHOMA—New Distillate Pay						
Noble	Fourdee	Midland Cooperative & Eason Oil Co's Hughes 1, se ne ne 26-22n-2w	4-14-49	4785	4694- 4724	Bartlesville sd; Penn	F 144; 45 mln	
		PENNSYLVANIA—New Gas Field						
Cambria		Peoples Natural Gas Co's Clearfield & Bituminous Coal Co. 1-3831, Elder Twp.	4- 7-49	5262	3205- 3250		F .04 mln; open	
		TEXAS—District 1 (SOUTH CENTRAL) New Oil Fields						
Caldwell	"Lane"	R. V. Muckelroy's Dave & Joseph 1, 8400 fr el 2400 fr sl of Byrd Lockhart Sur, 1½ mi e of Lockhart.	4-15-49	1637	1596- 1637	Austin ch; U Cre	P 61	41
Guadalupe	"Wolf Creek"	Parker Pet Co's Otto Engelke 1, 4700 fr sel 450 fr swl of Harriett Cottle Sur 14, 9 mi sw Luling.	4-16-49	2215	2170- 2215	Buda li; L Cre	P 70; 68 wtr	36

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New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in April, 1949

Also Important Extensions to Established Fields

(CONTINUED)

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		TEXAS—District 2 (MIDDLE GULF) New Oil Pays						
Calhoun	Sheriff	Quintana Pet Corp's C. H. Boyd 7, 1700 fr sl 1250 fr sel of Bonifacio Rordiguez Gr.	3-29-49	10550	9018- 9042	.....	F 187; 1/8"	49
Goliad	Terrell Point	Gasoline Prod Corp & Pan American Prod Co's Etta Terrell 4, 467 fr nwl of Geo. McKnight Sur, 2960 n-ne of Terrell 1-B.	3-25-49	5015	4679- 4685	.....	F 82; 1/8"	26
Victoria	Victoria	Scurlock Oil Co's H. E. Diebel 1, 330 fr se&swl of Blk 2, Rge 3-E, below Town Tracts, Victoria 4-Lge Gr.	4-21-49	5011	4587- 4598	.....	F 73; 6 wtr; 1/8"	27.2
		TEXAS—District 2 (MIDDLE GULF) Oil Field Extension						
Jackson	Little Kentucky	Gulf South Oil Corp's Mauritz Bros 2, 114.9-ac Lse, Jane A Pearce Sur 18, 1/2 mi n extension.	4-16-49	5835	5678- 5683	Frio sd; Olig	F 113; 1/8"	33.9
		TEXAS—District 2 (MIDDLE GULF) New Distillate Field						
Goliad	Breeden	Sunray Oil Corp's P. H. Breeden 1, 1750 fr el 467 fr sl of Joseph Simons Sur, 1 2/3 mi se Gottschalt fld.	3- 1-49	8210	4644- 4654 5082- 5094	Yegua sd; Eoc Cook Mountain sd; Eoc	no gge; 10.8 mln; open no gge; 8.2 mln; open	54 58
		TEXAS—District 2 (MIDDLE GULF) New Distillate Pay						
Jackson	Little Kentucky	Gulf South Oil Corp's Mauritz Bros 1, (OWDD), 330 fr sl 467 fr el of Lot 7, Jane A. Pierce Sur 18, 1/2 mi n of crude prod.	3-15-49	6043	5715- 5718	Frio sd; Olig	F 35; 3.4 mln; 1/4"	59
		TEXAS—District 2 (MIDDLE GULF) New Gas Field						
Jackson	.....	P. R. Rutherford & The Texas Co's Eugene Cihal 1, 330 fr n&el of I&GN Sur 5, 3 1/2 mi ne Cordele fld.	3-28-49	5516	2763- 2768	.....	F 93 mln; open	.....
		TEXAS—District 2 (MIDDLE GULF) New Gas Pay						
Live Oak	Fort Merrill	James G. McGarrick, Tr's Ida A. Richey et al 3, 2600 fr swl 4200 fr sel of P. Salinas Sur.	3-24-49	4620	3830- 3848	L. Pettus sd; Eoc	no gge	.....
		TEXAS—District 3 (UPPER GULF) New Oil Field						
Orange	Orange-Hackberry	Sun Oil Co's Brown Est 2, 1340 fr nl 2825 fr el of 674.8-ac Lse, B. Garner Sur, 1 mi e of Orange Dome prod.	4-17-49	6602	6544- 6554	Hackberry sd; Olig	F 146; 1/8"	43.9
		TEXAS—District 3 (UPPER GULF) New Oil Pays						
Austin	Raccoon Bend	Humble O&R Co's J. W. Wilson et al 10-Y, 416.5 fr nel 1600 fr nwl of 46.54-ac Tr.	4-21-49	7000	5544- 5568	Cockfield sd; Eoc	P 27	37.1
Galveston	Gillock, S.	Pan American Prod Co's Kohfeldt Comm 1-D, 430 fr el 330 fr sl of Lot 4, Blk K, Kohfeldt sbdn, Jas. Smith Sur.	4-16-49	9359	9334- 9354	.....	F 240; 1/2"	38.5
Liberty	S. Liberty	Texas State Drlg Co's Alexander Duessen 1, 3133.2 fr el 47.5 fr sl of 24-ac Lse.	4- 5-49	6045	5644- 5664	.....	F 163; 7/64"	41.2
Orange	Port Neches,	The Texas Co's James V. Polk NCT-1 8-A, 100.29-ac Lse, T. J. Notgrass Sur.	4-22-49	8209	6014- 6017	.....	F 188; 1/8"	31.8
Wharton	Kubela	The Texas Co's Selma Kainer 1, 2000 fr el 250 fr nl of Sect 25, I&GN Sur.	4- 1-49	4725	4579- 4585	.....	F 44; 1/16"	24
		TEXAS—District 3 (UPPER GULF) New Distillate Fields						
Jefferson	.....	H. B. Herbert, C. B. Claypool, J. C. Means, Jr's R. Burrell Hrs 1, 660 w&n fr sec of B. Blackman Sur, Lot 5, 1 mi se Hillebrandt Bayou fld.	4-21-49	8761	8453- 8458	Frio sd; Olig	F 83; 2 mln; 1/4"	63.8
Jan Jacinto	.....	Floyd L. Karsten's E. Malick 1, 330 fr n&wl of Lot 46, Masterson Irrig Co. Sbdn, S. Lusk Sur, 3 mi s Mercy fld.	3- -49	8683	8644- 8656	Wilcox sd; Eoc	no gge	.....
		TEXAS—District 3 (UPPER GULF) New Distillate Pays						
Jasper	Buna	Placid Oil Co's J. S. Richardson 3, 660 fr el 1980 fr sl of Weiss Sur.	3-18-49	7530	7424- 7428	.....	F 50; 2.5 mln; 3/16"	48
Wharton	Lissie	Magnolia Pet Co's Louise Mitchell 1, 1980 fr nwl 660 fr swl of Sect 21, GH&H Sur.	4- 9-49	9740	9582- 9680	Wilcox sd; Eoc	F 61; 2 mln; 7/32"	49.7
		TEXAS—District 3 (UPPER GULF) New Gas Field						
Wharton	.....	Houston Oil Well Service Co's Nancy D. Corbett 1, 1515-ac Lse, R. Kuykendall Lge, 15 mi nw Wharton.	3- -49	4515	3003- 3008	.....	F 36 mln; open	.....
		TEXAS—District 3 (UPPER GULF) New Gas Pays						
Wharton	Egypt	Claud B. Hamill's Northington Unit 1-1, 1400 fr nwl 330 fr swl of T. Heard Sur.	4- 2-49	7839	4287- 4292	Frio sd; Olig	F 1.9 mln; 1/4"	.....
Wharton	Hutchins	McDannald Oil Co's C. T. Zapp 1, 330 fr nel 467 fr sel of 158.2-ac Lse, Sect. 15, I&GN Sur.	4-13-49	4560	3120- 3133	.....	F 3.2 mln; 1/4"	.....
		TEXAS—District 4 (LOWER GULF-SW) New Oil Field						
Nueces	.....	The Atlantic Ref Co & Tide Water Assoc Oil Co's State Tr 436-1, 660 fr ne&nwl of Tr in Corpus Christi Bay, 12 mi s Aransas Pass.	3-31-49	9525	7433- 7442	.....	F 18; 4 wtr; 1/8"	41
		TEXAS—District 4 (LOWER GULF-SW) New Oil Pays						
Aransas	Copano Bay	Phillips Pet Co's "Aransas" (State Tr 35) 1, 660 fr nl 690 fr wl of State Tr 34, (Surface loc).	4- 1-49	7772	7685- 7690	.....	F 165; 11/64"	43
Hidalgo	Cecil	Clark Fuel Producing Co's Bemis Daskam et al 2, 1500 fr wl 712 fr sl of Lot 27, Porc 45, 1 1/2 mi se of prod.	3-29-45	4272	4259- 4262	.....	F 4; 1/4"	45.2
Kenedy	Sarita	Humble O&R Co's John G. Kenedy Jr Acct 1-9-B, 3359 s 3300w of nec El Paistle Gr.	4-16-49	9501	6258- 6268	.....	F 117; 1/8"	40.8
Nueces	Bailey	Skelly Oil Co's Minerva Patch 1, 467 fr e&sl of Sect 29, Richard King Fm Lots, 1 3/4 mi n-nw of prod.	4- 7-49	6600	5450- 5456	U King sd; Olig	F 121; 1/8	38.1
San Patricio	Plymouth, E.	Texon Royalty Co's W. L. Roots 2, 330 fr el 1089 fr sl of Lot 4, Sect 26, 4th Addn Taft Farm Lds.	4-21-49	5645	5129- 5137	.....	F 96; 7/64"	29.5
Starr	Coastal	Coastal Refineries, Inc & W. D. Kennard's Louis Pena 1, (OWWO), 330 fr wl 609 fr nl of Tr 151, Porc 38.	3- 9-49	4437	4074- 4078	.....	F 22; 3/16"	44.6
Starr	Jay Simmons	Geo. H. Coates' Villarreal 5, 2281 fr wl 2101 fr sl of 1296-ac Lse, San Jose Gr.	3-28-49	6655	6012- 6018	C-1 sd; Olig	F 191; 3/16"	44
Starr	La Copita	Humble O&R Co's J. J. Howell 1, 467 fr s&wl of CCSD&RGNG Sur 551	4-28-49	7007	6798- 6834	.....	F 47; 1/4"	43
Starr	La Copita	Rowan & Hope's Bentsen Bros 2, 467 fr nl 537 fr el of Sur 549	4-27-49	4950	4846- 4854	Frio "B" sd; Olig	F 97; 1/8"	45
Starr	La Copita	The Texas Co's Martinez-State 2, 467 fr sl 1400 fr el of Francisco Alvardo Sur 548.	4-22-49	7208	6566- 6569 6635- 6653	....	F 268; 3/16" P 22	45.5 .....
		TEXAS—District 4 (LOWER GULF-SW) New Distillate Fields						
Hidalgo	.....	Coastal Refineries, Inc's Yturria Land & Livestock Co 3, 2333 fr e&sl of 2,200-ac Lse, porc 43 & 44.	3- 9-49	8423	5920- 5950	.....	no gge	.....
Neuces	.....	Shell Oil Co, Ine's W. M. Bevly 1, 1000 fr el 4000 fr n'ly nl of Wm. J. Cody Sur, 3 mi s Clarkwood.	4- 1-49	11000	9914- 9948	.....	F 140; 2.9 mln; 1/4"	53
Starr	.....	Nelson Bunkder Hunt Trust Est's B. F. Gonzales et al 1, 330 fr n&el of Tr 8-A, Sb 2, Santa Teresa Gr Kelsey-N Sun Area.	3- 3-49	6810	4684- 4688	.....	no gge	.....
		TEXAS—District 4 (LOWER GULF-SW) Distillate Field Extension						
Hidalgo	San Salvador	Western Natural Gas Co's Santa Cruz Farms 1, 930 fr el 1320 fr nl of Lot 61, Santa Cruz Fm Sbdn, San Salvador Del Tule Gr, 1 mi s-sw extension.	3- 5-49	8992	6542- 6555 7675- 7700	Oligocene Oligocene	F 389; 58 mln; open F 85; 11.5 mln; open	57.8 53.8
		TEXAS—District 4 (LOWER GULF-SW) New Gas Field						
Duval	Cantu	The Texas Co's Canobio Cantu Jr 1, 330 fr sel 2318 fr nel of Benito Ramos Sur, 2 1/2 mi w of Cadena fld.	4- 4-49	5715	4674- 4678	.....	F 0.4 mln; 1/4"	.....
		TEXAS—District 6 (NORTHEAST) New Oil Field						
Wood	"Coats"	Bert Fields et al's W. W. Gilbreath 1, 330 fr s'ly sl 2300 fr e'ly wl of J. Stark Sur, 1 1/2 mi n cf Merigale-Paul fld.	4-14-49	5402	4508- 4520	Sub-Clarksville sd; U Cre	P 22; 82 wtr	14
		TEXAS—District 6 (NORTHEAST) New Gas Field						
Cherokee	.....	R. J. Caraway's Aarron Sessions 1, (OWWO), 330 fr n&swl of 132-ac Tr, J. M. Muxques Gr, 10 mi e Rusk.	4-28-49	4502	4403- 4417	Woodbine sd; U Cre	F 22 mln; open	.....
		TEXAS—District 6 (NORTHEAST) Gas Field Extension						
Shelby	Joaquin	Paul H. Pewitt's Pickering Lumber Corp 1-F, 467 se 1600 ne of nwc of H. A. Reed Sur, 3/4 mi se extension.	4-18-49	6200	4908- 4916 5968- 5992	Hill sd; L Cre L. Pettit li; L Cre	F 13.5 mln; open F 2.8 mln; open	....
		TEXAS—District 7-B (N. CENTRAL) New Oil Fields						
Coleman	"Ogden-Mabee"	Guy Mabee's C. E. Kennedy 1 OWDD), 660 fr n&wl of s1/2 of F. Owen Sur 310, 1 1/2 mi n Talpa.	4- 2-49	3125	3071- 3114	Palo Pinto li; Penn	P 203	43.5

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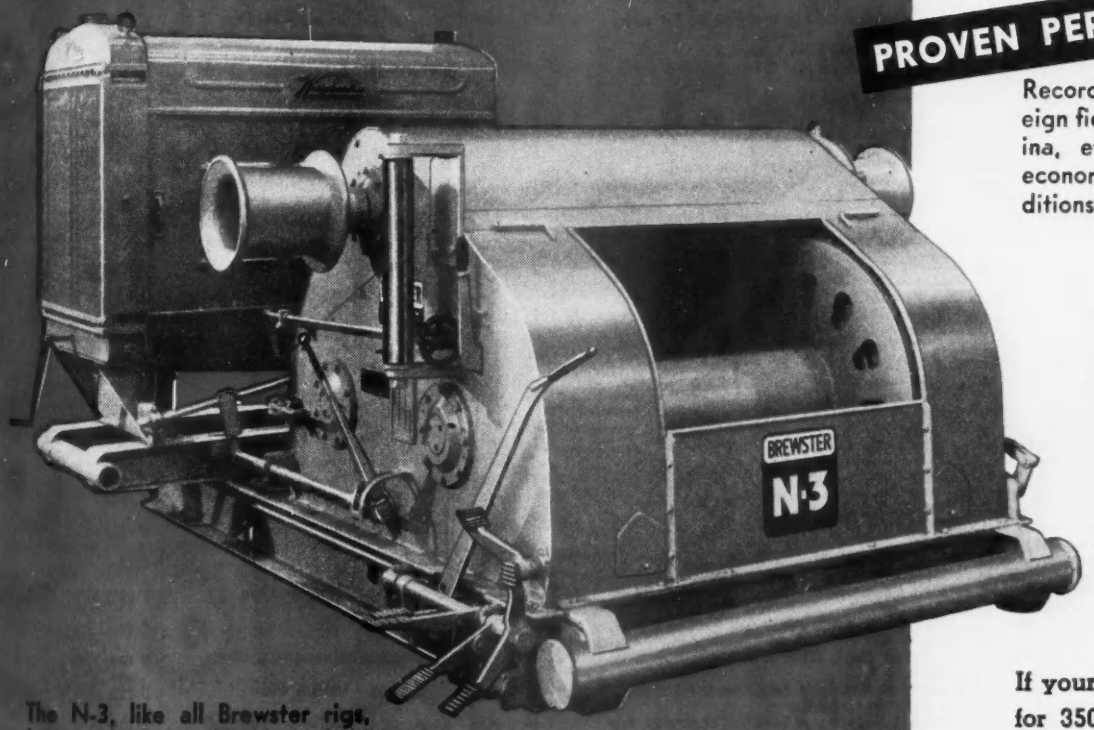

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Also Important Extensions to Established Fields

(CONTINUED)

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
Comanche		Castle Oil Co's J. Dealy Smallwood 1, 770 fr nl 1134 fr wl of Blk 21, Lampasas CSL Sur, 3 mi sw Sipe Springs.	4-14-49	428	426- 428		P 11	41
Comanche		G. A. Walter Jr et al's D. R. Brown 1, 467 fr s&wl of n½ of nw¼ of Sect 58, D&DA Sur, 5 mi sw Gorman.	4-27-49	3218	3187- 3218	Ellenburger dolo; Ord	P 4	42.3
Eastland		Roaller Production Co's L. Underwood 1, 1150 fr sl 1875 fr el of Sect 44, Blk 2, ETRR Co Sur, 2 mi ne pioneer.	4-15-49	3201	2442- 2530	Caddo li; Penn	P 70	40
Fisher		T. P. Coal & Oil Co's A. E. Pardue 1, (OWDD), 330 fr s&wl of se¼ of Sect 199, Blk 1, H&TC Sur, 4 mi nw Hamlin.	4-14-49	6100	3772- 3782 5948- 5984	Swastika sd; Penn Ellenburger li; Ord	F 127; 4/16" F 79; ¼"	39.9 42.1
Fisher		Woods Drilling Co's J. M. Radford & S. C. Shell 1, 660 fr n&wl of S. A. Barnard Sur, 4 mi sw Royston fld.	4-29-49	4740	4732- 4740	Canyon sd; Penn	F 154; 5/16"	38.4
Shackelford		C. E. Brownfield's W. H. Green 2, 250 fr sl 1350 fr wl of sw¼ of Sect 56, Blk 11, T&PRR Sur, 9 mi s Albany.	3-29-49	1133	1003- 1024		P 4	....
Stephens		McElroy Ranch Co's Will Ackers 1, 1464 fr nl 416 fr wl of Jas Lee Sur, 1 mi nw Breckenridge pl.	4-19-49	4524	3205- 3209	Caddo li; Penn	F 112; 8/32"	40.2
Throckmorton		Cities Service Oil Co's Swenson Ld & Cattle Co 1, 330 fr n&wl of ne¼ of Sect 100, BBB&C Sur, 12 mi nw Throckmorton.	4-11-49	5617	4956- 4976	Caddo cgl; Penn	P 29; 89 wtr	....
Throckmorton		Fred M. Manning Inc's Ed McCluskey Unit 1, (OWWO), 840 fr sl 1263 fr wl of Sect 264, BBB&C Sur, 5 mi nw Throckmorton.	4- 6-49	5250	4620- 4655	Caddo li; Penn	P 6	40
Throckmorton		Woodley Pet Co's Garland H. Webb 1, 2930 fr nl 330 fr wl of Sect 913, TE&L Sur, 4 mi sw Woodson.	4- 1-49	4480	4463- 4480	Mississippi li; Miss	F 175; ¼"	41
		TEXAS—District 7-B (N. CENTRAL) New Oil Pays						
Haskell	Not named	Pan American Prod Co's W. G. Windeborn 2, 1255 fr sl 1413 fr wl of A. F. Burchard Sur, 955 nw of discovery.	4- 5-49	4860	2918- 2923		P 20	36.6
Shackelford	"Kadane-Beaumont"	G. E. Kadane & Sons & Harry Beaumont's Sanders-Tate 2, 400 fr nl 1263 fr el Sect 1564, TE&L Sur, 12 mi e Albany.	3-25-49	4052	3611- 3615	Caddo li; Penn	F 154; 22/64"	40.5
Shackelford	Shackelford Co. Reg.	Danciger O&R Co & Intex Oil Co's Edwards Heirs 1, 330 fr nl 1650 fr wl of w½ of Sect 22, LAL Sur, 4½ mi sw Sedwick.	4-26-49	4351	4131- 4144	Mississippi cgl; Miss	F 291; ⅛"	40.3
Stephens	Stephens Co. Reg.	Star Oil Co Inc's Ed Ford 1-E, 467 fr nl 1940 fr el of Sect 5, Blk 1, SPRR Sur, 7½ mi ne Ivan.	3-28-49	4098	4066- 4098	Caddo li; Penn	F 130; 5/16"	43
		TEXAS—District 7-B (N. CENTRAL) New Gas Fields						
Coleman		Horace E. White's W. H. Finley 2, 330 fr el 948 fr sl of Sect 45, BBB&C Sur. 2½ mi se Novice.	4-30-49	3552	3401- 3427	Gardner sd; Penn	F 3.1 mln; open	....
Eastland		J. J. Lynn's Tom Noble 2, 660 fr nl 2600 fr wl of Sect 45, Blk 4, H&TC Sur, 2 mi w Eastland.	4- 8-49	3954	2963- 3073	Caddo li; Penn	F 4 mln; open	....
		TEXAS—District 7-C (W. CENTRAL) New Oil Fields						
Runnels		The British American Oil Prod Co's C. B. Hays 1, 3475 fr 4850 fr sl of A. Lessassier Sur 174, 2¾ mi ne Northington pl.	4- 5-49	4434	4056- 4077	Caddo li; Penn	P 34; 38 wtr	46.5
Runnels	"Giesecke"	Easter-Wood Prod Co's H. Giesecke 2, 330 fr s&wl of Blk 121, J. Hughes Sur 227, 15 mi se Ballinger.	3-22-49	1954	1780- 1792	Gunsight li; Penn	P 54	35.3
Runnels	"North Winters"	Geo. W. Strake's B. A. Jacob 1, 4595 fr sl 2035 fr wl of Sect 83, J. Hensley Sur, 4 mi nw Winters.	4-12-49	2825	2811- 2825	Gunsight sd; Penn	F 433; ½"	41
		TEXAS—District 7-C (W. CENTRAL) Oil Field Extension						
Crockett	Vaughn	Oliver & Kotyza's Shannon 1-A, 330 fr s&el of Sect 5, Blk UV, GC&SF Sur, ½ mi n extension.	3-25-49	1465	1430- 1465	San Andres li; Perm	F 61; 5/16"	24
		TEXAS—District 8 (WEST) New Oil Fields						
Andrews		McAlester Fuel Co's M. M. Fisher 1, (OWDD), 660 fr s&wl of Sect 4, Blk A-36, PSL Sur, 4½ mi e Shafter Lake fld.	4-21-49	11297	11005-11105	Devonian	F 5; 2 wtr; open	29
Bordon		Seaboard Oil Co & Pan American Prod Co's T. J. Good 1, 1985 fr sl 2004 fr wl of Sect 37, Blk 33, T-4-N, T&P Sur, 6 mi nw Vealmoor fld.	4-14-49	8010	7910- 7940	Canyon li; Penn	F 488; ¼"	41
Midland		The Texas Co's Clarence Scharbauer et al 1, 660 fr s&wl of Sect 20, Blk 40, T-2-S, T&P Sur, 1 mi s Warfield.	4-11-49	13374	13060-14130	Ellenburger dolo; Ord	F 39; 6 wtr; 5/8"	46.9
Scurry	Sharon Ridge-Canyon"	Humble O&R Co's Richard Bishop et al 1, 660 fr s&wl of Sect 164, Blk 97, H&TC Sur, 2 mi sw Ira.	3- 4-49	6680	6665- 6680	Canyon li; Penn	F 349; ⅜"	44.7
Scurry		Placid Oil Co's Mrs. W. W. Early et al 1, 467 fr nl 660 fr wl of J. P. Smith Sur 1, Sect 26, Blk 1, 5 mi se Dermott area.	4-14-49	7548	7520- 7545	Strawn sd; Penn	F 291; ½"	39
		TEXAS—District 8 (WEST) New Oil Pay						
Pecos	Shearer	Childress Royalty Co's J. S. Masterson 3 (OWDD), 450 fr sel 150 fr nel of Sect 104, Blk 10, H&GN Sur.	4-27-49	1708	1696- 1708	Grayburg li; Perm	P 75; 32 wtr	30
		TEXAS—District 8 (WEST) Oil Field Extensions						
Andrews	Shafter Lake-Devonian	Kewanee Oil Co's University 1-C, 660 fr s&wl of se¼ of Sect 12, Blk 13, Univ Lds Sur, north extension.	4-10-49	9944	9821- 9938	Devonian sd; Devo	F 355; open	36.8
Gaines	Robertson	The Texas Co et al's A. B. Wharton 1, (OWDD) 660 fr nl 1980 fr el Sect. 3, Blk A-22, PSL Sur, 2 mi se extension.	4-21-49	6535	5950- 5982	Clear Fork li; Perm	P 80; 98 wtr; open	28
Pecos	Pecos, H. G.	Culbertson & Irwin Inc's San Pedro Land Co. 1, 330 fr n&el of Sect 3, Blk 213, N. J. Ashmore Sur, ¾ mi s extension.	4-29-49	1370	1333- 1350	Yates sd; Perm	F 16; 1"	32.2
		TEXAS—District 8 (WEST) Gas Field Extension						
Andrews	Block 12	Champlin Ref Co's University 1-I, 660 fr s&el of Sect 27, Blk 12, Univ Lds Sur, 1½ mi s extension.	3-26-49	8605	2840- 3050	Yates sd; Perm	F 1.5 mln; open	....
		TEXAS—District 9 (NORTH) New Oil Fields						
Archer		Akin & Dimock's R. Campbell 1, 1700 fr nl 933 fr wl of Sect 1381, TE&L Sur, 4 mi ne Olney.	4-26-49	5131	5073- 5085	Mississippi li; Miss	F 121; ½"	44
Grayson		Burk Royalty Co's L. C. Neathery 1-A, 550 fr s&el of Chas. Quillen Sur, 1½ mi e Collinsville.	4-15-49	3936	3953- 3960		P 20	....
Montague		R. J. Carawy & P. C. Bundy's Clingingsmith 1, 1647 fr nel 2960 fr nwl of J. Winn Sur, 1 mi w Minor fld.	4-21-49	6327	6292- 6303	Bend cgl; Penn	F 900; ½"	43
Wilbarger		Frank Wood's W. T. Waggoner 1-O, 2490 fr sl 1470 fr el of Sect. 16, Blk 13, H&TC Sur, 3 mi sw Electra.	4-18-49	2421	1045- 1052		P 48	41.8
Young		The Pure Oil Co's Jennie K. Jeffrey Est 1, 171 fr nl 264 fr wl of Sect 54, TE&L Sur, 3 mi ne Padgett-Miss. fld.	4-29-49	5275	4820- 4856	Mississippi li; Miss	F 194; 174 wtr 12/64"	44.2
Young		Tom B. Medders & J. Newton Huff's Jas. R. Marshall Est 1, 467 fr e&sl of Sect 755, TE&L Sur, 2 mi s Holbert-Caddo fld.	4-11-49	3875	3867- 3875	Bend li; Penn	F 765; ½"	42
Young		Warren Oil Corp's The Allar Co. 1-N, 2400 fr nl 4500 fr el of Frac D, Sect 3410, TE&L Co Sur, 1 mi se Allar fld.	4- 5-49	3558	3549- 3554	Caddo li; Penn	F 129; 8/32"	....
		TEXAS—District 9 (NORTH) New Oil Pays						
Archer	Not named	Noranda Oil Corp's H. O. Prideaux 2, 450 fr nl 330 fr wl of Blk 16, John Dorsey Sur.	4-26-49	712	629- 639	Gunsight li; Penn	P 5; 8 wtr	38
Young	Lynn	A. B. Edwards et al's Lynn 1-C, 330 fr s&wl of J. T. Miller Sur.	3- 6-49	2616	2612- 2616	Kisinger Strawn sd; Penn	F 233; 11/64"	41
		TEXAS—District 9 (NORTH) Oil Field Extensions						
Clay	Joy	Fain & McGaha's Lilyan Chilson 1, 330 fr e&sl of Blk 28, H. Williams Sur, ½ mi n extension.	4-25-49	3918	3908- 3918	Strawn sd; Penn	P 90	41
Jack	Cherryhomes	Star Oil Co Inc's J. B. Rutledge 1, J. G. Gardner Sur, 1 mi se extension.	4-22-49	4652	4611- 4650	Bend cgl; Penn	F 183; 11/32"	42
		TEXAS—District 9 (NORTH) New Gas Field						
Young		Texas Pacific O&G Co's F. L. Donnell 1, 467 fr nel 900 fr nwl of Sect 1212, TE&L Sur, 3 mi s Kendall fld.	4-13-49	4730	4088- 4093		F 13.5 mln; open	....
		WEST VIRGINIA—New Gas Field						
Preston		William E. Snee's Sisler 3, (OWDD), Portland District.	4- 7-49	5795	5792- 5794	Oriskany sd; L. Devo.	F 2 mln; open	....
		WYOMING—New Oil Field						
Weston	Lodge Pole	Bay Pet. Corp's Lanam & Weir's Christensen-Davis 1, c nw se 9-44n-66w.	4-26-49	6737	6720- 6724	Dakota s; U Cre	P 25; 40 wtr	....
		WYOMING—New Oil Pays						
Carbon	Hatfield	Ohio Oil Co's Union Pacific 4, c se se 35-20n-88w.	4-20-49	4450	4320- 4420	Nugget sd; Jur	F 40; 13 wtr	35
Hot Springs	Golden Eagle	Phillips Pet Co. & Pioneer Oil Co's Golden Eagle 1, nw se sw 12-45n-97w.	4-15-49	9582	9458- 9542	Tensleep sd; Penn	F 410; open	42.6

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hour rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Directional Drilling In Offshore Operations

By GEORGE B. PARKS
Production Superintendent, Kerr-McGee Oil Industries, Inc.

PROBLEMS encountered in drilling shallow wells from off-shore platform under conditions involving high angle hole are discussed and illustrated by procedure followed in successfully completing one well under rigorous deflection requirements.

SUCCESSFUL application of high angle directional drilling of unconsolidated sands in Gulf Coast offshore drilling operations at Kerr-McGee Oil Industries, Inc.'s discovery on Block 32 about 12 miles from the Louisiana shore, marks an important step in future development of such reserves and answers a question which may represent the saving of millions of dollars in future drilling costs.

Kerr-McGee's discovery, which sparked the intensive search for oil on the continental shelf off the Louisiana and Texas coasts, found commercial production in post- or late-Miocene sediments above a piercement-type salt dome at depths ranging from 1700 to 2800 feet. The tremendous location costs associated with offshore exploratory and development drilling prompted the experiment to see what could be done to drill one or more wells from the same platform with the application of presently developed high angle methods in the loose, unconsolidated sediments of the new discovery. Although high angle directional drilling has been used in the exploration and development of the Creole pool located immediately offshore from Cameron Parish, Louisiana, the objective of 600 feet deviation in 1700 feet of vertical depth with such loose sands as are present in the Block 32 pool had not been attempted, to the author's knowledge, and was an objective well above the tried and accepted practices in the industry. The difficult requirements were presented to the service company and its proposal to set the first primary tool under the conductor pipe and deviate both surface and oil string hole was accepted.

Two wells have been drilled and successfully completed. Shown are the plan and profile views of proposed and drilled courses of Wells 2 and 3, as well as survey records and drilling progress records. The general methods used which have been well described by Weaver, as well as by Jackson and Murdoch, consist of setting primary deflection tools and building angle which is increased at some 2½ to 3 degrees per 100 feet by use of a limber bottom drilling assembly with a reamer to act as a fulcrum.[1,2] If the limber assembly is building angle at excessive rates the assembly is stiffened to retard rate of angle increase. Should the fulcrum and bottom assembly fail to build angle at the necessary rate or if direction is not maintained as planned, additional primary tools are set. Progress is checked and the work is controlled by both open hole and inside drill pipe directional survey instruments. Control is aimed at keeping within a 100-foot or other specified diameter cylinder. (Ed. Actually a

About the Author

GEORGE B. PARKS, a native of Beaumont, Texas, completed the Petroleum Engineering course at Texas A. & M. and was with Stanolind Oil & Gas Company on the Gulf Coast until he entered service with the U. S. Engineers. After completion of his military service he served at Odessa, Texas, as district engineer for Sunray Oil Corporation, and left that post to enter the offshore development program of Kerr-McGee Oil Industries, Inc. He is now Gulf Coast division production superintendent for that company, with headquarters at Morgan City, La.

theoretical "circle" or "target.") Tools are oriented in the hole by bottom-hole methods as well as by the Stokenbury projected plane method.

The whipstock is the only primary tool that has been necessary to date and it will be noted in the progress graph of Well 2 that the number of tools set has not been excessive. Experience on the first well enabled improved performance to be made on the second well and no doubt further refinements such as obtaining a 30-foot K-monel pup joint for inside survey shots will further increase performance. The 30-foot joint was not available for Wells 2 and 3 and the 13-foot joint was satisfactory only up to a drift angle of about 19 degrees.

Procedure on First Well

A resume of work on the drilling of the first directional well on the Kerr-McGee Block 32 discovery will give information as to the manner of applying the general methods previously mentioned to drill this deviated hole.

CONDUCTOR HOLE: A total of 154 feet of 16-inch conductor pipe was set and cemented 8½ degrees north of Well 1 after the hole had been drilled without the aid of a "shoe joint" or any device for drilling fluid returns. Conductor hole was drilled with sea water and filled with mud prior to running the conductor pipe.

SURFACE HOLE: After drilling out cement in the conductor pipe with a 15¼-inch rock bit, surface hole was drilled to 221 feet. An open hole survey shot at this point revealed a vertical hole. A ten-inch whipstock was then run with a 7⅝-inch rock bit, two joints of 3½-inch drill pipe and a 7¾-inch outside diameter by 30-foot drill collar. By means of the drill collar, necessary weight to flex the 3½-inch drill pipe was applied and enabled an increase in angle from the whipstock setting. At this depth the Stokenbury projected vertical plane method of orientation was deemed most practical and was used to set the whipstock. Thirteen feet of hole was made off this tool with all the available weight, about 25 revolutions per minute rotary table speed and a very slow pump. This 13 feet was followed up after removing the whipstock with a 37-foot run using the same bottom hole assembly, all available weight, 100 rpm rotary table speed and a slow pump. Open hole directional survey shots were taken at 238 feet

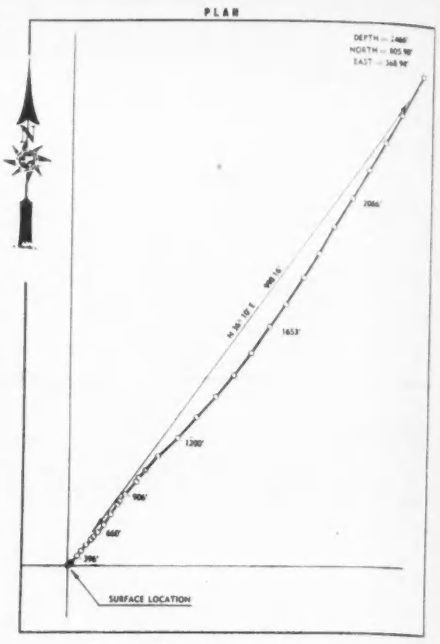

FIGURE 1.

showing 3¾° N 39° E and at 258 feet reading 5¼° N 38° E. The hole was then reamed to 12¼-inch diameter with a pilot reamer. A somewhat stiffer bottom assembly was then used to drill to 459 feet at which point check shots inside the K-monel metal drill collar showed the angle to be accelerating at an insufficient rate when the shot at 459 feet read 8¾° N 39° E. The stiffer bottom assembly, consisting of 12¼-inch rock bit and 12¼-inch reamer with smooth rollers and a 22-foot K-monel metal 7¾-inch O.D. drill collar and two joints of 3¼-inch drill pipe, was then changed to a limber bottom hole assembly consisting of 12¼-inch rock bit, 12¼-inch O.D. reamer with smooth rollers, one 4¾-inch O.D. K-monel pup joint 13 feet long and two joints of 3½-inch drill pipe. Hole was then drilled to 528 feet at which point the hole was N 45° E with angle of 11½°. Electrical survey was attempted before and after reaming the 12¼-inch hole to 15¾-inch but electrode would not go below 230 feet. The pilot bit used in reaming the hole was specially built for the job having a ten-inch O.D. "stinger" or guide 3½ feet in length. The unusually large stinger diameter was used to prevent loss of angle while reaming. Surface pipe, 10¾ inches in diameter, was set at 508 feet.

OIL STRING HOLE: After waiting on cement and drilling the plug with salt water, mud weighing 10 pounds per gallon, viscosity 40 seconds, WL 12cc, sand 4 percent and salt content 2000 parts per million was used to displace the salt water and drilling resumed. Single shot pictures taken at 528 feet showed 10° drift N 42° E. A limber bottom hole assembly as above described but with

TABLE 1
Record of Survey, Well 2

	Measured Depth	Drift Angle	True Vertical Depth	Course Deviation	Drift Direction	RECTANGULAR COORDINATES North	East
1	221.00	0° 00′	.....	0.00	VERTICAL	0.00	0.00
2	238.00	3° 45′	.....	1.11	N 39° 00′ E	0.87	0.70
3	258.00	5° 30′	.....	1.92	N 39° 00′ E	2.37	1.91
4	296.00	6° 15′	.....	4.14	N 40° 00′ E	5.54	4.57
5	396.00	8° 15′	394.61	14.35	N 41° 00′ E	16.37	13.98
6	459.00	8° 45′	.....	9.58	N 39° 00′ E	23.81	20.00
7	528.00	11° 30′	.....	13.76	N 45° 00′ E	33.53	29.72
8	581.00	11° 45′	.....	10.79	N 42° 00′ E	41.55	36.94
9	611.00	12° 00′	.....	6.24	N 44° 00′ E	46.04	41.27
10	660.00	13° 00′	653.46	11.02	N 42° 00′ E	54.22	48.64
11	727.00	15° 30′	718.02	17.90	N 38° 00′ E	68.32	59.65
12	787.00	17° 45′	775.16	18.29	N 33° 00′ E	83.66	69.61
13	847.00	19° 30′	831.72	20.03	N 32° 00′ E	100.64	80.22
14	864.00	18° 30′	847.84	5.39	N 37° 00′ E	104.94	83.46
15	906.00	19° 30′	887.43	14.02	N 37° 00′ E	116.13	91.90
16	979.00	23° 00′	954.63	28.52	N 37° 00′ E	138.90	109.06
17	995.00	23° 15′	969.33	6.32	N 44° 00′ E	143.45	113.45
18	1039.00	25° 15′	1009.13	18.77	N 46° 00′ E	156.48	126.95
19	1109.00	26° 15′	1071.91	30.96	N 45° 00′ E	178.37	148.84
20	1200.00	28° 00′	1152.26	42.72	N 44° 00′ E	209.10	178.52
21	1290.00	30° 00′	1230.20	45.00	N 43° 00′ E	242.01	209.21
22	1380.00	30° 15′	1307.95	45.34	N 42° 00′ E	275.70	239.55
23	1470.00	30° 45′	1385.30	46.02	N 42° 00′ E	309.89	270.34
24	1554.00	32° 45′	1455.95	45.44	N 37° 00′ E	346.18	297.68
25	1653.00	33° 00′	1539.98	53.92	N 35° 00′ E	390.35	328.61
26	1735.00	34° 30′	1606.56	46.45	N 34° 00′ E	428.86	354.58
27	1820.00	35° 45′	1675.54	49.66	N 34° 00′ E	470.03	382.35
28	1900.00	37° 00′	1739.43	48.15	N 32° 00′ E	510.87	407.87
29	1981.00	38° 00′	1803.26	49.87	N 31° 00′ E	553.61	433.55
30	2066.00	39° 15′	1869.08	53.78	N 31° 00′ E	599.70	461.25
31	2156.00	39° 00′	1939.02	56.64	N 31° 00′ E	648.25	490.42
32	2246.00	37° 00′	2010.90	54.16	N 32° 00′ E	694.17	519.12
33	2337.00	36° 30′	2084.05	54.13	N 32° 00′ E	740.07	547.81
34	2466.00	37° 00′	2187.07	77.63	N 32° 00′ E	805.90	588.94
			CLOSURE	998.16′	N 36° 10′ E		
35	2663.00	32° 30′	2353.22	105.84	N 33° 00′ E	894.67	646.58
36	2860.00	28° 00′	2527.15	92.49	N 34° 00′ E	971.34	698.30
37	2984.00	25° 15′	2639.31	52.90	N 35° 00′ E	1014.67	728.64
38	3133.00	22° 00′	2777.46	55.81	N 35° 00′ E	1060.39	760.65
39	3211.00	20° 00′	2850.76	26.68	N 35° 00′ E	1082.25	775.95
			CLOSURE	1331.68′	"N 35° 38′ E		

NOTE: Readings at 2663′ and 3211′ are interpolated.

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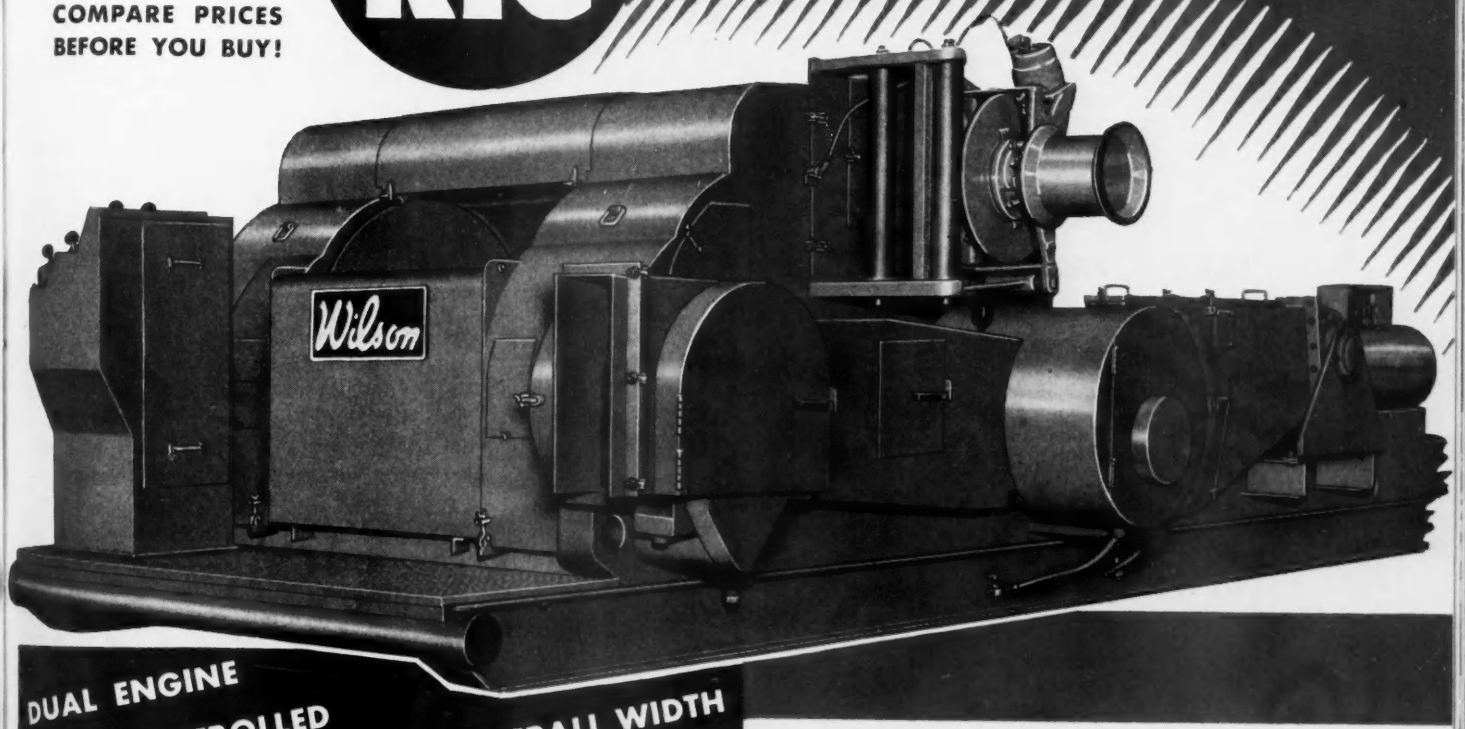

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9⅞-inch tools was run to bottom and hole drilled and surveyed inside pipe to 754 feet. At this depth the inside survey read 21° N 36° E and it was decided to make an outside survey shot because of the possibility that the 13-foot K-monel pup joint (4¾-inch O.D.) might not isolate the surveying instrument from the magnetic field of the drill pipe. An open hole shot gave a reading of drift 21° and bearing N 42° E. To enable the survey to be made of the hole while drilling ahead the following bottom assembly was run: 9⅞-inch rock bit, 9⅞-inch reamer with smooth rollers and a 7¾-inch O.D. K-monel drill collar 22 feet long. The remainder of the string was 4½-inch drill pipe. This assembly was either too stiff to follow the hole or the hole had bridged and stopped at 540 feet. In an effort to clear the bridge the hole was sidetracked. Efforts to regain the hole consisted of running both a limber pilot reamer assembly and a knuckle joint without success. The knuckle joint rathole made while attempting to regain the old hole was now reamed to 9⅞-inch or gauge with the same stiff assembly that was used when the bridge was encountered and eliminated any adverse effects of the knuckle joint setting. A picture taken at 581 feet showed 11¾° drift N 42° E. The limber bottom assembly above mentioned as used to start the oil string hole was picked up and re-run with six tons of weight on the bit, 20 strokes per minute of 7¾-inch by 18-inch power pump, and a rotary speed of 65-70 rpm. This bottom hole assembly built angle at a satisfactory rate but between 611 and 847 feet it made a turn to the left, going north of the objective bearing from N 45° E to N 32° E as revealed by an open hole shot at 847 feet, with a drift of 19½°. To correct this deviation from the intended course a 7½-inch retrievable whipstock was run with a bottom hole orienting sub and two joints of 3½-inch drill pipe above the bit. The tool was oriented on bottom S 56° E and 17 feet of rathole was made. After following this run with a pilot reaming bit to maintain hole gauge, a single shot survey record at 864 feet showed 18½° deviation N 37° E.

A limber bottom assembly was run to increase the angle and possibly secure more right turn following the whipstock run. Hole was made from 864 to 979 feet using 35-40 rpm rotary speed, slow pump and six tons of weight (all available) on the bit. An open hole survey record made at 979 feet read 23° deviation N 37° E. It was then necessary to run another whipstock to correct bearing of the hole, and the 7½-inch whipstock was again run using bottom hole orientation S 67° E. After reaming a 16-foot rathole the open hole survey record at 995 feet showed N 44° E 23¼° deviation.

To accelerate angle the limber bottom assembly was re-run and drilling was continued with this hook-up to 1039 feet, at which point the drill pipe was pulled for an open hole check which revealed 23¼° N 46° E. To eliminate the possibility of sidetracking and to condition the hole before running a stiff assembly, the hole was reamed from the casing shoe to total depth with the following

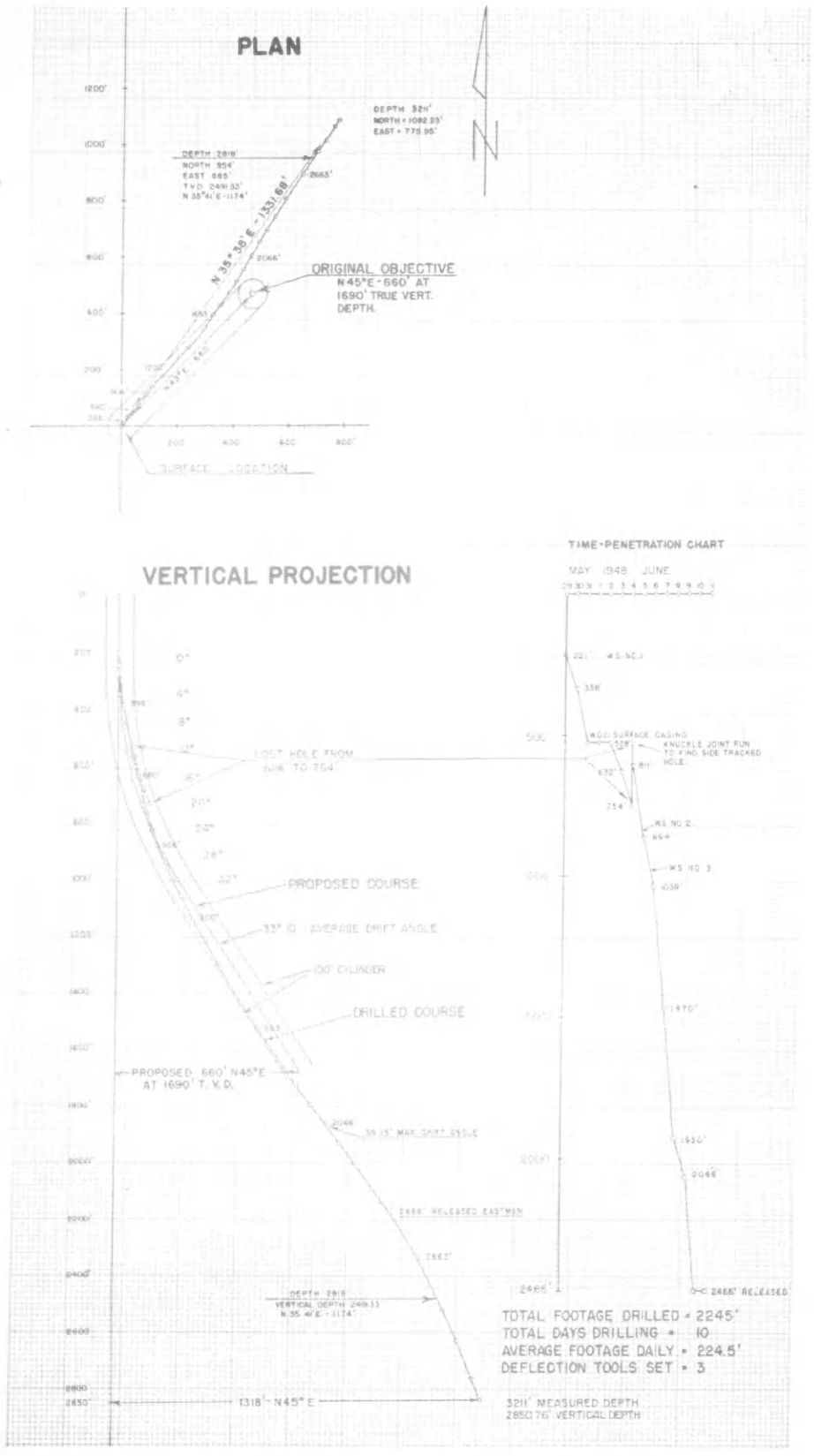

FIGURE 2. Kerr-McGee Industries, Inc., State Lease 754, Block 32, No. 2, Gulf of Mexico.

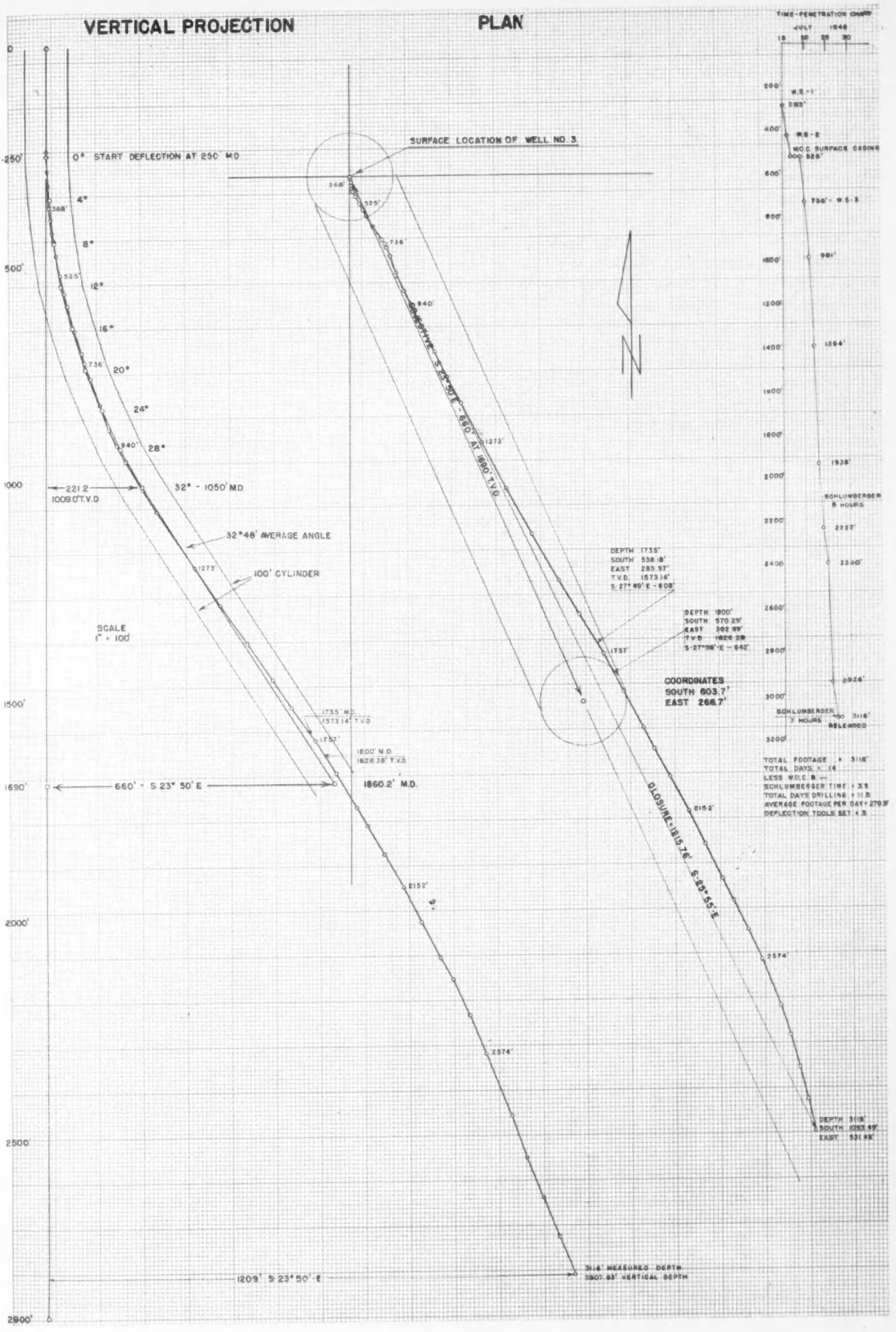

FIGURE 3. Kerr-McGee Industries, Inc., State Lease 754, Block 32, No. 3, Gulf of Mexico.

assembly: 9⅞-inch pilot reaming bit, one joint of 4½-inch drill pipe, 9⅞-inch string reamer, two joints of 3½-inch drill pipe and the balance of the 4½-inch drill string. After reaming the hole and conditioning mud the reamer was pulled and the stiff K-monel metal 22-foot by 7¾-inch O.D. drill collar assembly was run to bottom without any difficulty or drag at any point. The hole was then cut to 1470 feet and survey showed 30¾° N 42° E. In order to build a total angle of 33 degrees and remain in the cylinder the limber bottom hole assembly was again run. Hole was cut to 1560 feet and survey revealed that the hole again was turning to the left, or north, with a reading of 32¾° N 37° E. If the hole were to be kept inside the 100-foot diameter cylinder a whipstock setting would be necessary; however, it was decided that unless this left turn took on magnitude which would amount to more than a few feet outside the cylinder it would be of no consequence on the first directional hole. Subsequent holes could be run to closer control if necessary. A bottom drilling assembly consisting of a 9⅞-inch rock bit, a 9⅞-inch reamer with smooth rollers and a K-monel metal 22-foot by 7¾-inch O.D. drill collar was run on the 4½-inch drill pipe and hole made from 1560 to 1900 feet. Bit weight of seven tons (all available) rotary speed of 50 rpm and 400 pounds per square inch pump pressure were used throughout this interval. Shots inside the K-monel drill collar showed that the tendency to turn off to the left had continued and that an increase in drift angle of about 1¼ degrees per 100 feet had been obtained. Open hole survey at 1900 feet showed deviation 36¾° N 32° E. Drilling with this assembly was continued to 2066 feet and an electrical log was run at 1980 feet and at 2066 feet. The logs were run without difficulty and sidewall cores were obtained after logging at 2066 feet.

Bottom Hole Assembly

A bottom hole assembly consisting of a 9⅞-inch fishtail bit, a 22-foot by 7¾-inch O.D. K-monel drill collar and a 30-foot by 7¾-inch O.D. steel drill collar was then picked up and run to drill ahead. This assembly was selected as angle building was no longer a requirement. Drilling was begun with 6000 pounds of weight on the bit, 75-80 rpm rotary speed and 450 pounds per square inch pump pressure. The weight on the bit was increased to 10,000 pounds at 2246 feet in order to check a rapid drop in angle from 39 degrees to 37 degrees in 90 feet. Mud tests were run throughout the 2065-2483-foot interval and showed: averaged weight 10.4 pounds per gallon, viscosity 43 seconds, pH 8.5, sand 7 percent, salt 2500 ppm, 2/32-inch filter cake, WL 12cc. Hole was made to 2483 feet and single shot survey at 2466 feet read drift 37° N 32° E. Drill pipe was pulled for electrical survey and sidewall samples. The electrical survey revealed that additional seven-inch casing would be needed and a pilot bit was run on the 4½-inch drill pipe, and circulation and conditioning of the mud carried on until additional pipe was on hand. Mud conditioning prior to cementing was: weight 9.8 pounds per gallon, viscosity 35 seconds, sand 2½ percent, salt 1500 ppm and WL 15cc. The seven-inch O.D. pipe was run to 2232 feet and cemented without centralizers or wall scratchers.

This well was drilled to salt with 2½-inch external upset ends tubing and 6⅛-inch rock bits and the angle allowed to decrease at a rate not to exceed the 2½ to 3 degrees per 100 feet as can be seen in the records. Salt was topped at 3207 feet and drilling stopped at 3238 feet after a salt indication in the mud. Logging and sampling revealed a good oil sand at 2806-24 feet and a 5½-inch 15.5 extreme line liner was hung from 2187 feet to 3211 feet after underreaming the 6⅛-inch hole to 8 inches with a hydraulic-type underreamer.

The well was completed for an initial production of 700 barrels of oil per day from perforations at 2808-24 feet. Working with completion tools in the deviated hole has developed some difficulties such as failure to collapse packer elements without additional weight while the sanding troubles, in the author's opinion, are also aggravated. The latter difficulty is probably the result of a hanging wall situation and has been noted by other operators where unconsolidated sands are cut at steep dip in a vertical hole.

TABLE 2
Record of Survey, Well 3

	Measured Depth	Drift Angle	True Vertical Depth	Course Deviation	Drift Direction	RECTANGULAR COORDINATES South	East
1	238.00	0° 00′	.....	0.00	VERTICAL	0.00	0.00
2	253.00	2° 00′	.....	0.52	S 30° 00′ E	0.45	0.26
3	283.00	2° 15′	.....	1.18	S 29° 00′ E	1.48	0.83
4	317.00	2° 30′	.....	1.48	S 28° 00′ E	2.78	1.52
5	368.00	5° 15′	367.73	4.67	S 14° 00′ E	7.31	2.65
6	396.00	6° 00′	.....	2.93	S 07° 00′ E	10.22	3.00
7	426.00	8° 30′	.....	4.43	S 04° 00′ W	14.64	2.69
8	444.00	9° 25′	.....	3.05	S 20° 00′ E	17.51	3.74
9	481.00	10° 15′	.....	6.58	S 25° 00′ E	23.47	6.52
10	525.00	12° 00′	522.44	9.15	S 26° 00′ E	31.69	10.53
11	568.00	12° 15′	.....	9.12	S 31° 00′ E	39.50	15.23
12	598.00	13° 15′	.....	6.88	S 29° 00′ E	45.52	18.57
13	659.00	15° 00′	.....	15.79	S 32° 00′ E	58.91	26.94
14	719.00	17° 15′	.....	17.79	S 35° 00′ E	73.49	37.14
15	736.00	18° 30′	726.00	5.39	S 34° 00′ E	77.96	40.15
16	753.00	19° 00′	742.07	5.53	S 26° 00′ E	82.92	42.57
17	779.00	20° 00′	766.50	8.89	S 23° 00′ E	91.10	46.05
18	840.00	20° 15′	823.73	21.11	S 21° 00′ E	110.81	53.62
19	900.00	22° 00′	879.36	22.48	S 23° 00′ E	131.50	62.40
20	940.00	26° 00′	915.31	17.53	S 25° 00′ E	147.39	69.80
21	981.00	30° 00′	950.82	20.50	S 26° 00′ E	165.82	78.78
22	1059.00	31° 30′	1017.33	40.75	S 27° 00′ E	202.12	97.28
23	1119.00	32° 45′	1067.79	32.46	S 28° 00′ E	230.77	112.51
24	1181.00	33° 00′	1119.79	33.77	S 27° 00′ E	260.86	127.84
25	1273.00	34° 00′	1196.06	51.45	S 28° 00′ E	306.29	151.99
26	1376.00	35° 00′	1280.44	50.08	S 28° 00′ E	358.45	179.72
27	1484.00	34° 45′	1369.17	61.56	S 29° 00′ E	412.29	209.56
28	1588.00	35° 30′	1453.84	60.39	S 30° 00′ E	464.58	239.75
29	1666.00	35° 45′	1517.14	45.57	S 31° 00′ E	503.64	263.22
30	1757.00	35° 45′	1590.99	53.17	S 31° 00′ E	549.22	290.61
31	1848.00	32° 30′	1667.74	48.89	S 29° 00′ E	591.98	314.31
32	1938.00	31° 30′	1744.48	47.02	S 28° 00′ E	633.50	336.39
33	1990.00	31° 30′	1788.82	27.17	S 29° 00′ E	657.25	349.56
34	2062.00	31° 00′	1850.54	37.08	S 28° 00′ E	689.99	366.97
35	2152.00	29° 30′	1928.87	44.32	S 28° 00′ E	729.12	387.78
36	2242.00	28° 15′	2008.15	42.60	S 27° 00′ E	767.07	407.12
37	2333.00	28° 15′	2088.31	43.07	S 27° 00′ E	805.44	426.67
38	2390.00	29° 00′	2138.16	27.63	S 27° 00′ E	830.06	439.21
39	2480.00	25° 15′	2219.56	38.39	S 25° 00′ E	864.85	455.43
40	2574.00	23° 00′	2306.09	36.73	S 24° 00′ E	898.41	470.37
41	2726.00	22° 00′	2447.02	56.94	S 23° 00′ E	950.82	492 61
42	2826.00	21° 00′	2540.38	35.84	S 18° 00′ E	984.91	503.69
43	2926.00	22° 15′	2632.93	37.86	S 16° 00′ E	1021.31	514.13
44	3021.00	23° 00′	2720.38	37.12	S 14° 00′ E	1057.32	523.11
45	3116.00	23° 00′	2807.83	37.12	S 13° 00′ E	1093.49	531.46
			CLOSURE	1215.76′	S 25° 55′ E		
..	1735.00	35° 45′	1573.14	40.30	S 31° 00′ E	538.18	283.97
..	1800.00	34° 20′	1626.38	18.05	S 30° 00′ E	570.29	302.89

NOTE: The Readings at 1735′ and 1800′ are Interpolated.

ACKNOWLEDGMENT

The author acknowledges the use of detail notes made by John Lloyd, Jr., observer of the directional drilling of the No. 2 Block 32 well for stanolind Oil and Gas Company, and to the Kerr-McGee Oil Industries, Inc., for permission to publish this article.

REFERENCES

[1]Weaver, D. K., Practical Aspects of Directional Drilling. API Drilling & Prod. Practice, 1946, page 9.

[2]Jackson, John G., and Murdock, J. B., Jr.: AIMME Tech. Paper 2325.

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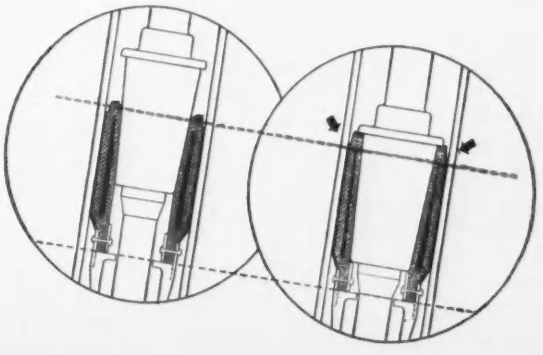

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Control of Heaving Shale With Sodium Silicate Muds

By WILLIAM V. VIETTI
Producing Department, The Texas Company

THE SODIUM SILICATE drilling mud process which has resulted from 15 years of research and field work is a specific cure for the heaving shale problem. Extensive use of the process in more than 100 wells since 1936 in heaving shale belts has shown the process to be economically attractive, and has enabled the driller to achieve his objective in every case. Proper use of the techniques developed is the only requirement for satisfactory drilling results in heaving shale.

A PRONOUNCED expansion of the drilling horizon is now a possibility as a result of the successful development and use of sodium silicate to control heaving shale. Sodium silicate mud, as a chemical drilling tool, makes possible the drilling of wildcat wells and also new wells in proven territory which otherwise would not be attempted. Oil and gas fields which might not be discovered and developed are now within reach of the bit.

Although sodium silicate mud was used as long ago as 1934, it brought in the early days a number of new problems and for this reason was not readily accepted by drillers in the heaving shale area. Only recently have these problems been thoroughly understood and satisfactory techniques for handling them established. Prior to using sodium silicate mud, knowledge of heaving shale was very limited, because few wells were able to penetrate these zones sufficiently to obtain enough information to study the problem. The purpose of sodium silicate is to prevent the hydrous disintegration of the soft colloidal shales which disintegrate readily in water. Cores taken in some of the early wells drilled with sodium silicate provided samples of shale with which to work, and this resulted in numerous improvements in the composition of sodium silicate muds. The use of the more effective sodium silicate muds eliminated many of the early problems, and allowed numerous improvements in drilling practice which have resulted in the industry now having a method for drilling through heaving shales, not so long ago thought impenetrable. Since 1936 more than 100 wells have been drilled with sodium silicate mud. The objective of the operator has been achieved in every case, and at a reasonable cost. Thus, the operator now knows in advance of drilling that if he starts a well and uses the sodium silicate process he is practically certain to reach his objective. J. P. Weichert of Gulf Oil Corporation recently stated[17] "Although this (silicate-brine type of mud) is not a new development, it is the only drilling fluid, at present, with which we can drill through heaving shale."

Heaving shales have been reported in the Gulf Coast Area, Northern California, New Zealand, Ecuador, Colombia and some other South American areas. In the Gulf Coast area they have been encountered over a 50-mile wide belt from New Orleans to Brownsville, at depths ranging between 6000 and 10,000 feet. In this belt in the U. S. geologically they are found in the Jackson, in the upper Eocene, Vicksburg, and in the Lower Oligocene.

Gulf Coast Problems

The most serious drilling problems have been encountered in the Gulf Coast heaving shale belts. From sixty-odd case studies available, three have been selected and are presented below. In each case it will be noted that unusually severe conditions were encountered.

In known heaving shale country around Edgerly, La., a successful producer was brought in at 9330 feet in 1945. This well has produced more than 300,000 barrels of oil and has made its allowable of approximately 268 barrels per day continuously. A number of attempts had previously been made to explore the possibility of deep production in this structure, but in each case the objective was not reached because of the heaving shale.

Original plans, which were followed, called for setting 9⅝-inch casing at 8000 feet, which is the approximate top of the troublesome shale zone, with a change to silicate mud after setting the casing, and then drilling on to 10,000 feet. Prior to setting the casing, an electric log was run. Adopting a 14-pound per gallon silicate mud at 7985 feet, which was later increased to 16.7 pounds, drilling proceeded to 9600 feet. After topping a sand at this depth, the driller started out of the hole, and with about 12 stands of pipe out, the well attempted to blow out. This condition was complicated by lost returns, against a mud weight of 16.7 pounds. In kicking, the mud showed much gas and oil. At 9520 feet the lost returns were corrected with the addition of mud-sealing materials. It was thought that a sand had been encountered at 9600 feet with an unexpectedly high pressure which accounted for the attempted blowout. As the drilling operation was resumed, cores were taken from 9600 to 9630 feet, but these showed only shale. An electric log was run and it showed about 15 feet of oil sand at 9300-15 feet. An oil string of casing was then set at 9300 feet and the well completed as a producer from the sand at 9315-30 feet. It is interesting that in

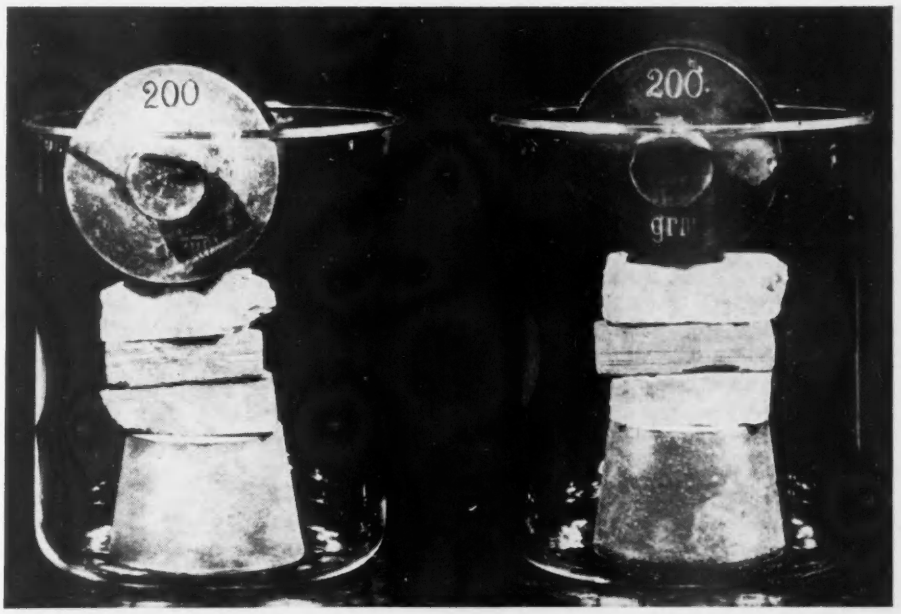
spite of the heaving shale section which had given so much trouble in previous wells, the abnormally high pressures encountered, and the attempted blowout and lost returns, the sodium silicate mud protected the hole to such an extent that trouble was not experienced due to heaving or caving.

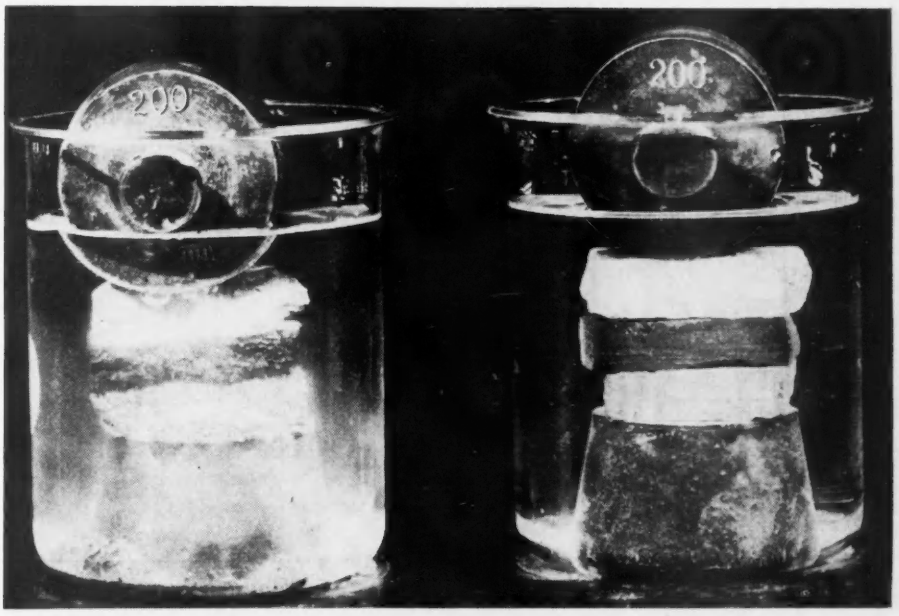
The well on test made 30 barrels per hour of 40-gravity oil on a 5/32-inch choke with 4300 pounds pressure on the tubing, and 40 barrels per hour on a 3/16-inch choke. Four months later, the producer had flowed more than 40,000 barrels of oil at the rate of more than 300 barrels a day with 4200 pounds tubing pressure on a 6/64-inch choke.

Abandoned Well Deepened

Another outstanding well[13] on the flank of the Hitchcock field near Galveston, Texas, was successfully drilled to 12,588 feet despite heaving shale in the upper portion of the hole and high pressure salt water flows below 10,000 feet. This well had previously been abandoned at 7781 feet because of difficulties in controlling the shale with water-base muds. It was decided about a year later to attempt to deepen the hole to 11,500 feet. The hole was cleaned out and drilling resumed with a heavy water-base mud. Increasing difficulty was encountered from heaving shale and, at 8215 feet, it was decided to change to sodium silicate mud because it was apparent that the water-base material had reached the limit of its possibilities. Casing of 7⅝ inches was run to 8189 feet where it stuck. The mud was then changed to sodium silicate, and a 6⅝-inch hole drilled to 12,588 feet.

After changing to silicate mud, very little trouble was encountered from heaving shale. However, below 10,000 feet, a number of abnormally high pressure salt water flows were encountered. In an effort to hold back these salt water flows, the mud was weighted to 17.2 pounds. With a weight of much over 17.2 pounds lost returns were encountered, and under 17.2 pounds the salt water flow could not be held beck. Within this close balance of weight it was possible to reach the objective. The





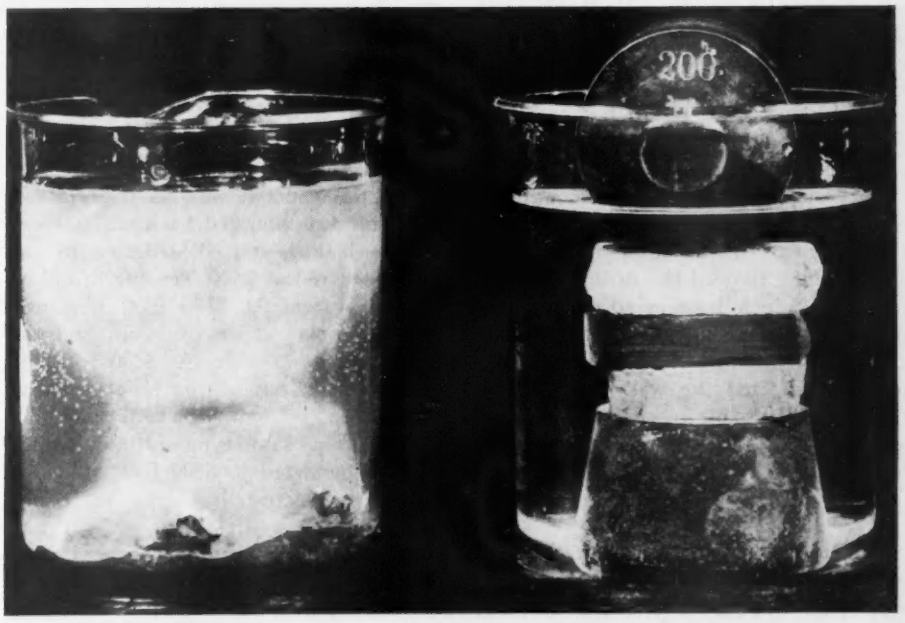
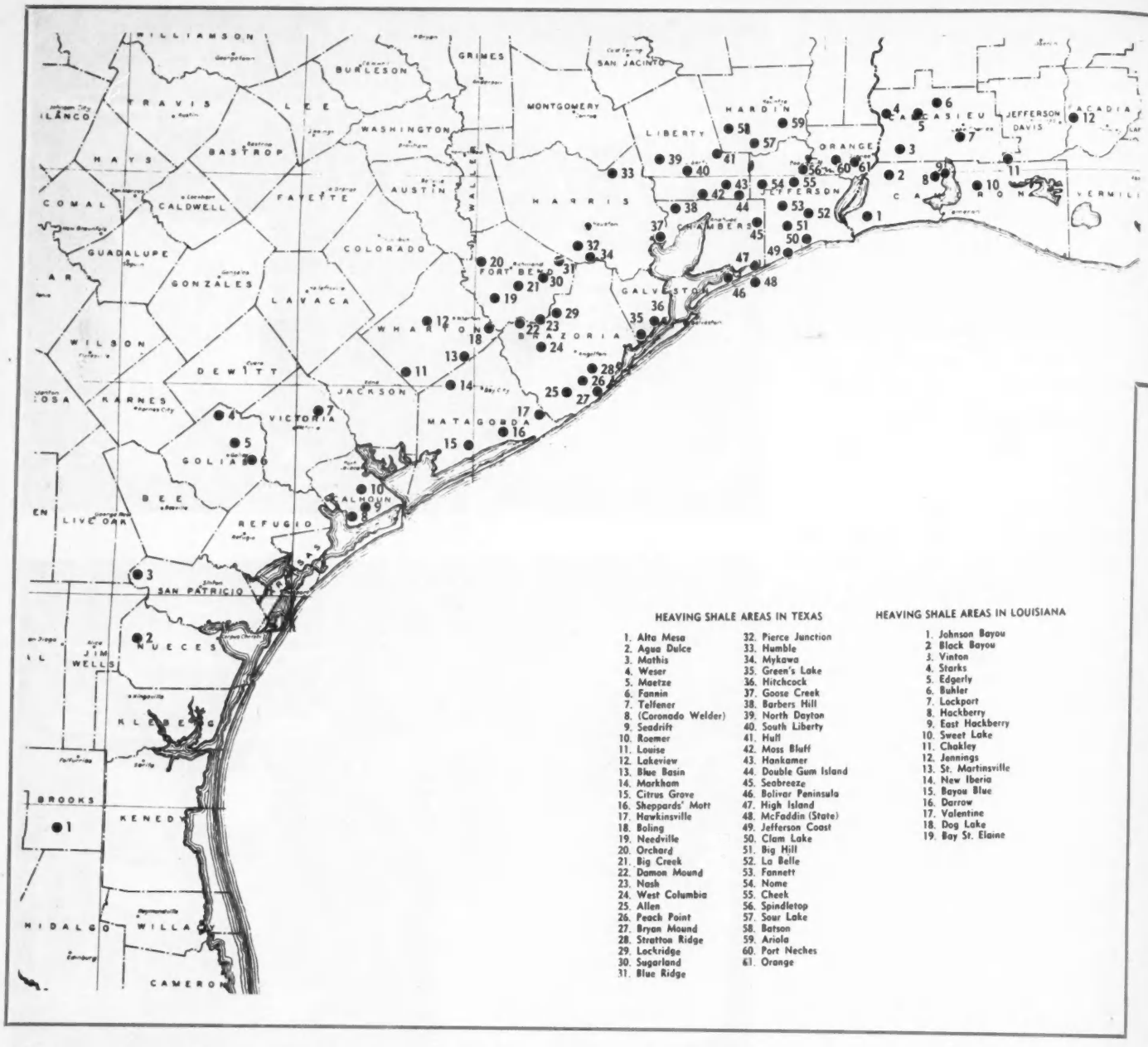


FIGURE 1 (top): Identical shale samples. Reactive shale specimen lying between two strata of non-swelling shale, elevated in glass beakers on hard rubber stoppers with 200 gram weights placed on top.

FIGURE 2 (center): Shale strata same as in Figure 1, except water added to left-hand beaker and sodium silicate solution to right-hand beaker. Note disintegration beginning in left-hand beaker after 30 seconds.

FIGURE 3 (lower): Complete breaking down of shale in left-hand beaker as indicated by total submersion of 200-gram weight after five minutes.



difficult conditions encountered, which were a combination of soft heaving shales, high pressure salt water, and structurally weak formations, did not prevent the operators from obtaining all of the desired geological information. Several zones were tested but commercial production was not established. This operation is a typical example of the variety of problems usually encountered when drilling wells through heaving shale zones. In this case the sodium silicate mud allowed the drilling of 4400 feet of 6⅝-inch hole in soft shale formation. It withstood almost constant salt water contamination, and it so completely protected the walls of the hole that it was possible to run electric logs, and finally 5½-inch casing was run to bottom.

Objective Achieved

In another case, a severe heaving shale problem was encountered near Bay City, Texas. The objective was accomplished by drilling to over 12,000 feet. The hole had been previously drilled to 7505 feet. At 6740 feet, a bridge plug was set and it was decided to change from a water-base mud to sodium silicate. The silicate mud was started at a weight of 15.5 pounds per gallon. A check revealed the hole had started going crooked around 7120 feet and at 7500 feet it was six degrees off. The hole was plugged back to 7100 feet and re-drilling started. Dilution of the mud occurred at 7500 feet due to inflow of salt water. At 7739 feet, the mud was remaining quite constant, and the hole gave no trouble. At 8200 feet, the driller pulled out of the hole to check for balled bit, as tightness had developed. This same type of difficult shale drilling persisted to 8500 feet, at which point an electric log was run. The logging tool went down without any difficulty. The electric log showed three salt water sands between 7480 and 7600 feet which were evidently the source of mud dilution experienced, but other than this the log showed only shale. At 8785 feet the viscosity and gel strength started jumping, and it was decided to make a complete change of the silicate mud system. After the hole was cleaned, drilling proceeded satisfactorily with the new mud. At 11,761 feet the mud was again changed and drilling resumed. Mud weight was increased to 16.4 pounds and drilling went ahead to a total depth of 12,512 feet. An electric log was run to bottom, and the drillers and backers reported they were pleased with the performance of the silicate mud.

In each of the three cases, heaving and sloughing were prevented by the proper use of sodium silicate mud in spite of unusual circumstances and an unusually difficult set of drilling problems. In one case the well had been previously abandoned before adoption of the silicate mud, and in the other two cases, certain failure would have

Preliminary U. S. Department of the Interior Bureau of Mines map of Gulf Coast showing points where heaving shale has been encountered.

resulted without the aid of silicate mud. More and more it is becoming recognized that it is good business when drilling in formations where difficulties may be encountered to have sodium silicate available to make sure that the well may be carried on to its objective despite formational troubles.

Effects of Heaving Shale

Heaving shales may occur in beds several hundred feet thick, but more frequently occur in thinner strata interspersed with other materials. The presence of these shales has offered a costly and, many times, impassable barrier to deeper drilling. Heaving shale is difficult to characterize, as there is often a continuous gradation of shale swelling and hydration.

Heaving shale may affect the walls of the hole in various ways. The shale, in some cases, will absorb water from water-base muds so hungrily that it swells out into the hole, constricting its diameter and seizing the drill pipe. By repeated reaming, this situation may be solved temporarily, but this is expensive and eventually results in caving. Heaving shale will also disintegrate. When a stratum of such shale is penetrated by the bit using water-base mud, the shale disintegrates and sloughs or slakes off into the mud stream, creating a cavity which eventually reaches such a size that the overhanging harder shales heave or cave. This often results in loss of the hole. With either type of shale, abandonment of the well usually results, often with loss of part of the drill stem and sometimes the lower part of the casing string. Sodium silicate mud checks hydration of the shale, and keeps it stable.

In deep drilling it is imperative to keep the mud in proper condition at all times. If the hazards of lost returns, gas cutting and blow-outs are to be controlled, the weight, viscosity, gel strength and walling properties must not vary appreciably from the optimum values. The bit cuttings from highly reactive shales break down in ordinary drilling muds and are not removed from the mud by shakers. The disintegration and hydration of cuttings in ordinary drilling mud tends to raise the viscosity and gel strength of the drilling mud very rapidly and often makes them difficult and expensive, if not impossible, to control. Sodium silicate mud largely prevents this hydration and its adverse effect upon viscosity and gel. When drilling with sodium silicate mud, bit cuttings of even the most reactive shales are carried to the surface unaltered and can be removed by the shaker screen. As a result of not making mud from the formation drilled, the physical properties of silicate mud can easily be controlled within the narrow limits necessary for drilling difficult wells.

In drilling a wildcat or a well in proven territory in a known heaving shale belt, the real problem is the location of the top of the shale sufficiently in advance to enable the driller to change muds before he gets stuck. Almost always the driller attempts to use a water-base mud until he is certain that he is encountering the heaving shale, and frequently it is then too late to make the change. This is partially explained by the fact that by nature drillers are mechanically rather than chemically inclined, and their successful drilling accomplishments over the last ten years have made them even more prone to be this way. The problem is further complicated by the fact that there is an infinite variety of shales subject to hydrous disintegration and it is difficult to make a sharp distinction between what is and what is not heaving shale.

A certain test for determining the presence of shale which has a tendency to heave or slough in a given hole is to take the center of a fresh core and drop it in a glass of water. Within five minutes the shale will disintegrate or swell if it is the type that will cause the driller trouble. When cores are allowed to dry before making this test, they become deceptive in that many will disintegrate in water when they would not in their natural state. When the original moisture content of the sample is preserved, the test is infallible.

The Use of Sodium Silicate

The process of using sodium silicate for the control of heaving shale has been developed over the past 15 years by The Texas Company and Philadelphia Quartz Company. This experience has taught the manufacturers and users of this material much about its effective use. Since sodium silicate mud is more costly than water-base muds, some drillers are inclined not to use it until they encounter a shale so serious that it will stop progress entirely. With present geological information, however, it is fairly easy to estimate the depth at which these shales appear and, therefore, the time at which sodium silicate mud should be used. In general a casing program is desirable which will provide maximum protection and allow drilling to the projected depth at minimum cost. Ordinarily it is considered good practice to case the well before switching to silicate mud. If the hole is cased before switching, the problem of wall sloughing is, of course, eliminated above the casing and minimized below the casing. It is not always possible to anticipate heaving shale trouble, however, and many times in the past mud systems have been changed to sodium silicate with large amounts of open hole. Under such conditions it is usual that the hole is not open to bottom due to previous heaving and caving troubles, and the mud change must be made at the top of the troublesome section.

Controlling Viscosity

Increase of viscosity due to accumulation of shale fragments in the silicate may be controlled by double screening or by the use of a finer screen. Thus, early mechanical adjustments may save a much more expensive reconditioning later.

It has been demonstrated that when an electric log is run in a well drilled with sodium silicate mud the log will be comparable to that obtainable with a water-base mud, and an accurate interpretation of what is in the formation may be made.

The dry powdered form of commercial sodium silicate may be dissolved in the usual mud hoppers and with "guns" in regulation pits. Available weighting materials may be added as desired. It has been found that with weighted sodium silicate mud, weights up to 19 pounds per gallon can be attained easily. These muds possess good pumping characteristics and can be used successfully to combat extremely high bottom hole pressures. The viscosity and gel strength require much less control than with water mud. The viscosity and gel strength of the mud may also be increased by adding the usual commercial clays. The muds require no chemical

treating agents, and those commonly used with water-base muds have little effect in the presence of sodium silicate. The mud builds a much thinner wall cake with a much lower water loss than do water-base muds. The liquid phase of the sodium silicate in the mud weighs 11.9 pounds per gallon as compared with eight pounds for water-base mud, so that less weighting material need be added to give a mud of desired weight. The amount of weighting material required to maintain a mud of given weight is also decreased because the mud requires addition of practically no liquid during the progress of drilling.

Typical Formula

A typical formula for making one barrel of sodium silicate mud is 155 pounds sodium silicate, 35 pounds salt, 15 pounds clay, and 0.82 barrels of water. This will make a 12-pound mud having suitable viscosity and other properties. The sodium silicate and salt dissolve in the water to give the liquid phase of silicate mud. It is important that the chemical composition of the liquid phase be maintained.

Laboratory work has shown that by combining certain water soluble salts with sodium silicate and finely divided amorphous silica the quantity of sodium silicate required in the drilling mud can be markedly reduced. This combination provides adequate protection against the heaving or sloughing of shale. In the selection of salts, one or more sodium or potassium salts of the following negative ions are employed: thiocyanate, chlorate, iodide, nitrate, bromide, chromate and chloride. Not less than 20 percent sodium silicate solution and not less than 2 percent of one of the salts (by weights of the aqueous medium of the drilling mud) are used.

Sodium silicate muds may be prepared in a number of ways, and with widely varying physical properties, as desired. The sodium silicate can be added to a previously prepared drilling mud and the salt added later; or a drilling mud may be formed by incorporating clay in a solution of sodium silicate and then dissolving the salt; or a saturated solution of the salt in water may be prepared, mixed with the proper amounts of sodium silicate, and clay or other suspended matter added finally.

The dry silicate of soda dissolves in the water of drilling mud to give a liquid. The mud effectively prevents swelling, sloughing, and the hydrous disintegration of even the most reactive of colloidal shales. The prevention of swelling and disintegration permits the formations to stand up and thus be drilled with ordinary bits, and drilling practices. Using sodium silicate, bit-marked cuttings of the softest shales reach the surface intact. By then removing these cuttings with a shaker screen, mud is not formed from the formation. With this material the moisture content is retained by the mud and does not escape into the surrounding shales. A reaction between sodium silicate and the shale tends to solidify the shale. The finer shale cuttings can be circulated continuously with little dilution and still maintain a uniform viscosity. Eventually, cuttings will accumulate in the mud and cause increased viscosities, but this can be minimized through the use of auxiliary shaker screens of finer mesh.

Better Production

Although positive proof is not available, there is some evidence to confirm the belief that a well drilled with sodium silicate mud is a better producer than one drilled with a water-base mud. The sodium silicate prevents water blocking of sands, and consequent swelling of shale and clay particles, which in many cases occur interstitially in sands. Also much better casing cement jobs are obtained when the hole is drilled with sodium silicate mud as fewer cement squeeze jobs have been required to complete a satisfactory producer.

Sodium silicate mud, as has been described, costs about $8.50 per barrel made up at the rig, or in the same order of cost as oil-base muds, and somewhat higher than water-base and starch muds. The maintenance cost while drilling is often less than for other muds since no chemical treatment is required. In cases where it is feasible, the cost of the silicate mud may be reduced considerably by re-using the mud in another well. The best way, however, to look at the cost of silicate mud is in terms of accomplishment; that is, in terms of a successfully completed well rather than a well abandoned because of drilling difficulties.

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[1] Garrison, Allen D., assr. to The Texas Company, New York, N. Y. U.S. 2,239,647—4/22/41, "Method of Drilling Wells."

[2] Vietti, William V. and Garrison, Allen D., assrs. to The Texas Company, New York, N. Y. U.S. 2,165,823 — 7/11/39, "Method of Drilling Wells."

[3] Vail, James G. and Baker, Chester, L., assrs. to Philadelphia Quartz Company, Philadelphia, Pennsylvania, U.S. 2,133,759—1/30/36, "Compositions for and Process of Making Suspension."

[4] Doherty, W. T., Gill, Stanley and Parsons, C. P. *The Cementer*, 3, No. 4, Sept. 1931, "Drilling Fluid Problems in the Gulf Coast."

[5] Mills, Brad, *The Oil Weekly*, p. 18, 7/16/34, "Scientific Research Needed to Solve Problem of Heaving Shale."

[6] Mills, Brad, *The Oil Weekly*, p. 18, 7/23/34, "Heaving Shale Involves Chemical and Mechanical Drilling Methods."

[7] Mills, Brad, *The Oil Weekly*, p. 27, 7/30/34, "Mechanics and Chemistry Involved in Heaving Shale Problems—Ultimate Solution."

[8] Mills, Brad, *The Oil Weekly*, p. 51, 3/16/36, "Heaving Shale Drilling Advanced."

[9] Baker, Chester L., and Garrison, Allen D., Trans. Amer. Inst. Chem. Engrs., No. 6, 34, 2/25/38, "The Chemical Control of Heaving Shale."

[10] Williams, Neil, *The Oil & Gas Journal*, p. 182, 1/26/29, "Practices Used in Drilling Agua Dulce Deep Test."

[11] Williams, Neil, *The Oil & Gas Journal*, p. 50, 6/5/41, "Salt Water Flow Successfully Combatted in Two Deep Coastal Wells."

[12] Wade, Gustav, Bureau of Mines Report, Investigation 3618, (1942), "Review of the Heaving Shale Problem in the Gulf Coast Region."

[13] Ward, Joe L., *The Oil Weekly*, p. 58, 10/16/44, "Overcoming Heaving Shale, Salt Water."

[14] Mills, Brad, *The Oil Weekly*, p. 75, 6/3/45, "Research Work Continues in Effort to Drill Heaving Shale."

[15] Dansby, R. E., *The Oil & Gas Journal*, p. 115, 6/23/45, "Drilling Mud Problems—With Suggested Solutions for Several Types."

[16] Chaney, P. E. and Oxford, W. F., Jr., *Petroleum Engineer*, 17,158 (June 1946), "The Chemical Treatment of Drilling Fluids."

[17] Weichert, J. P., *The Oil & Gas Journal*, p. 101, 8/26/48, "New Developments in Drilling Fluids."

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WILLIAM V. VIETTI was educated at the University of California, where he specialized in petroleum engineering and chemistry, and obtained a doctor's degree. After leaving college he was employed by Marland Oil Company, Ponca City, Okla., in 1926, and joined The Texas Company Producing department in 1929. He spent five years in Colombia, the first three as manager of the Texas Petroleum Company and the last two as vice president and manager of Colombian Petroleum Company and South American Gulf Oil Company on the Barco concession. He returned to the U. S. in 1943 and became chief petroleum engineer for The Texas Company.

Combination Casing Strings

By A. C. TEMMEL
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"COMBINATION CASING STRING" is a term generally applied to a casing string composed of more than one weight per foot, more than one grade of steel, or both. Particularly in the deeper wells, substantial savings can be effected by a suitable combination of weights and grades. These savings not only are advantageous from an original cost and freight standpoint, but also offer a lighter derrick load due to the reduction in total string weight. In the combination casing design used as an illustration, the weight saving over a straight single weight string amounts to 20 percent.

CERTAIN precautions are necessary in the design and running of the combination casing string, as extreme care must be exercised in handling in order to avoid mixing of the pipe so that a length would be placed in a section other than that for which it was intended. This calls for alert and responsible supervision and imposes a practical limit on the number of sections placed in the combination in the design stage. Consequently, the longer strings could have up to four sections while the shorter strings should be designed straight; that is, with a single weight and grade.

With the use of stronger tensile strength joints, care must be taken to be sure that the problem of internal pressure has been considered since the lighter pipe with upset or treated ends develops joint strengths considerably higher than regular non-upset API connections, without increasing the resistance to internal pressures. Without the use of the stronger joints it is necessary to use heavier pipe with the result that the resistance to internal pressures is increased along with the joint strength, and with the further result that the internal yield factor tends to be automatically controlled and consequently is sometimes ignored. On wildcat locations and in areas where high pressures are suspected, higher safety factors should be used for internal yield than in proven fields where bottom hole pressures can be reasonably estimated. Where high pressure areas are involved, many operators feel that higher pressure hydrostatic tests should be applied to the casing. Most pipe mills are now equipped to perform this supplementary hydrostatic test up to 80 percent of the internal yield of the material.

Design Comparison

A comparative illustration is shown in Table 1 in the design of a straight string of seven-inch outside diameter to 12,000 feet and a combination string to the same depth followed by the procedures involved in arriving at the design of the combination string. Safety factor requirements have been placed at 1.125 in collapse, 2.00 in ultimate strength in tension, 1.25 in yield strength in tension, and 1.00 in internal yield pressure, based on minimum properties, for the sample calculations. Field conditions vary so widely that definite safety factors cannot be recommended. For simplicity, we further assume that 9.62 pounds per gallon mud (72 pounds per cubic foot) is involved since this weight results in two feet of mud column for each pound of collapsing pressure.

In designing the combination string, make a sketch similar to Figure 1 and add the detailed description of each section as it is developed such as length, weight, type of joint, total section weight, safety factors, etc. To begin, select the lightest weight and grade of casing to resist the collapse at the bottom (12,000 feet). Since 9.62 pounds per gallon (72 pounds per cubic foot) mud was used at 1.125 safety factor, this can be selected from the column headed collapse from Table 2, as it was under such conditions this column was figured. A section of seven-inch, 32-pound N-80 is the first item reading down to exceed 12,000 feet and becomes the bottom section. The safety factor in collapse becomes the setting depth of the seven-inch, 32-pound N-80 at 1.125 safety factor in collapse (13,160 feet) multiplied by the safety factor (1.125) and divided by the depth (12,000 feet) or 1.233.

Correcting Collapse Resistance

The section above the bottom section will be one weight or grade lighter than that selected for the bottom. This then

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ANDREW C. TEMMEL graduated from the Carnegie Institute of Technology with a B.S. degree in mechanical engineering and joined the National Tube Company in 1924 at the Gary Works as a tracer and at Continental Works as a clerk. In 1926 he was transferred to the Pennsylvania Works as a tester and two years later was assigned to Oklahoma as field engineer. Between 1933 and 1945 he was a field engineer with headquarters at Tulsa, Fort Worth and Houston, successively, until his promotion to manager of engineering sales service, the position he now holds.

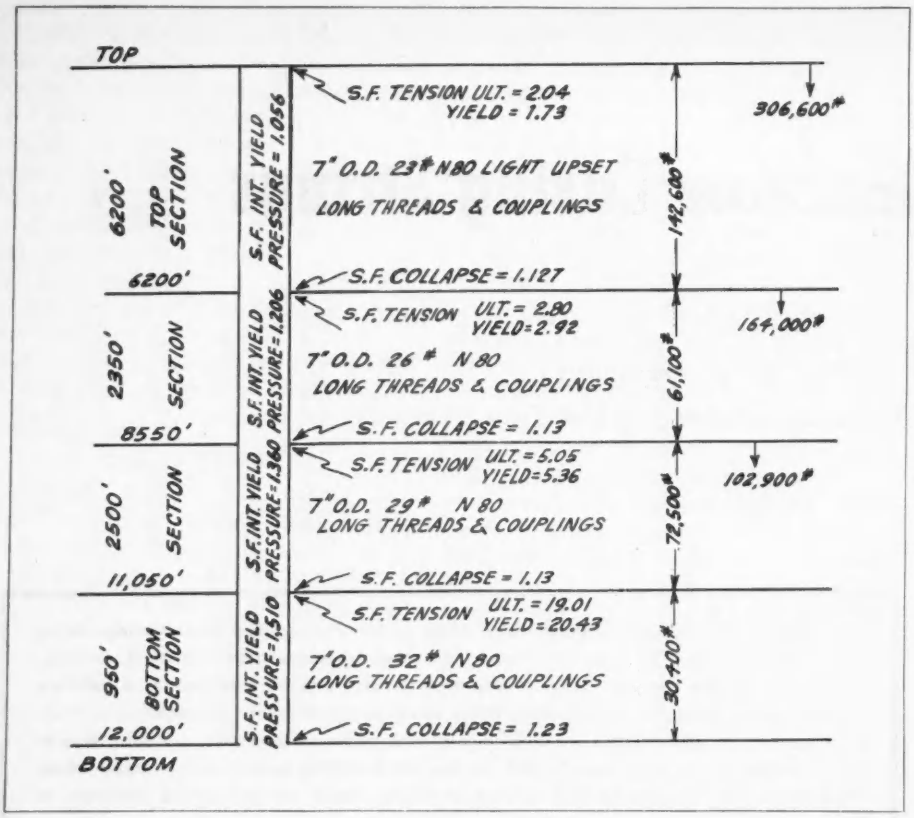


FIGURE 1. Work Sheet

will be seven-inch, 29-pound N-80 which normally would set, under the conditions assumed, to 11,320 feet. However, when there is casing hung below a section, as in all cases except the bottom section, the ability of the upper casing to resist collapse is reduced by the tensile load. This is graphically shown in Figure 2, which could be used in correcting the minimum collapse resistance for the effect of tension by obtaining the intersection of the proper diameter-thickness ratio for this second section, and the unit tensile stress of the bottom joint of this second section and reading to the left to obtain the corrected resistance to collapse.

Estimating With Table

Table 3 gives the minimum collapse resistance for each casing size and grade in 5000-pound increments of unit tensile stress along with the plain end area necessary in determining the unit tensile stress. The use of the table in preference to the graph minimizes errors in estimating the proper position of both the unit tensile stress and the proper diameter-thickness ratio and again the corrected collapse resistance resulting. To adjust the listed 11,320 feet setting depth for the seven-inch, 29-pound N-80 to the proper setting depth under the tensile load of the 32-pound bottom section, it is necessary to estimate the amount of the correction and check through calculations to see if the estimate is correct. Fortunately, an error in the original estimate results in an answer that gives the direction of the error, and, as experience is gained, also the magnitude.

Let is be assumed that 11,050 feet is the proper setting depth of the 29-pound under the tension imposed by the lower 32-pound section. Thus, 12,000 feet less 11,050 feet leaves 950 feet of 32 pounds per foot for the bottom section giving a total tensile load on the bottom joint of 29 pounds of 30,400 pounds (950 feet × 32 pounds per foot). The plain end area of seven-inch, 29-pound is shown in column five of Table 3 as 8.449 square inches, which divided into the tensile load of 30,400 pounds, results in a unit tensile stress on the 29-pound at 11,050 feet of 3598 pounds per square inch. By interpolating, the corrected resistance to collapse can be determined. In this the difference between the collapse resistances at zero stress (6370 psi) and at 5000 psi stress (6180 psi) is 190 psi, which, multiplied by the amount of stress between the zero and 5000 psi stress columns (all of the 3598 psi in this case), and divided by the 5000 psi difference in the adjacent columns, results in 137 psi to subtract from the 6370 psi to obtain 6233 psi as the collapse resistance of seven-inch, 29-pound N-80 under the stresses imposed. The collapsing pressure at 11,050 feet is 5525 psi (one psi for each two feet of depth under the 9.62 pounds per gallon mud assumed). Thus, the actual collapse resistance (6233 psi) divided by the actual collapse pressure at the point in question (5525 psi) gives a safety factor of 1.128 which slightly exceeds the requirement of 1.125. Thus, the bottom section will be 950 feet of 32-pound N-80.

Had the safety factor been less than 1.125, a longer section of 32-pound should be re-figured and had the safety factor exceeded 1.125 by too great a margin, less 32-pound could have been placed on the bottom.

This process can be repeated for the seven-inch, 26-pound N-80 to be placed above the 29-pound, remembering to use the weight of the 29-pound section plus the 30,400-pound from the 950-foot, 32-pound section and the plain end area of the 26-pound to determine the unit tensile stress. Using 2500 feet of 29-pound, the unit tensile stress at 8550 feet becomes 13,631 psi and the collapse resistance under this stress 4827 psi to meet a collapse pressure of 4275 psi at the 8550-foot depth to give a safety factor of 1.129 in the bottom joint of 26-pound.

Fourth Section

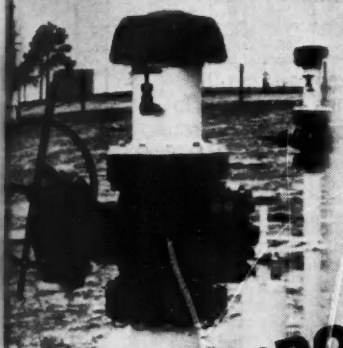
Since collapse has been figured for three sections, and four sections have been considered as a practical limit, it is necessary to figure collapse for one additional section, that being seven-inch, 23-pound N-80 (Table 2), to comply with one section or grade lighter than the section immediately below. The process of trial and correction for error in estimate, if encountered, applies. Assuming 6200

TABLE 1

Set Feet	Zone Feet		INSIDE DRIFT Diam. (In.)	INSIDE DRIFT Diam. (In.)	SAFETY FACTOR Collapse	SAFETY FACTOR Tension Ult.	SAFETY FACTOR Tension Yield	SAFETY FACTOR Int. Yield Press.
Straight String 7" O.D. x 12,000 ft. (String Weight 384,000 Lbs.)								
3000	0- 3000	7" 32lb N-80 Light Upset*	6.005	5.969	3.756	2.23	1.94	1.510
9000	3000-12000	7" 32lb N-80*	6.094	5.969	1.233	2.00	2.15	1.510
Combination String 7" O.D. x 12,000 ft. (String Weight 306,600 Lbs.)								
6200	0- 6200	7" 23lb N-80 Light Upset*	6.273	6.241	1.127	2.04	1.73	1.056
2350	6200- 8550	7" 26lb N-80*	6.276	6.151	1.129	2.80	2.92	1.206
2500	8550-11050	7" 29lb N-80*	6.184	6.059	1.128	5.05	5.36	1.360
950	11050-12000	7" 32lb N-80*	6.094	5.969	1.233	19.01	20.43	1.510

* Long Threads and Couplings.

GAS LINE BLOW-DOWN



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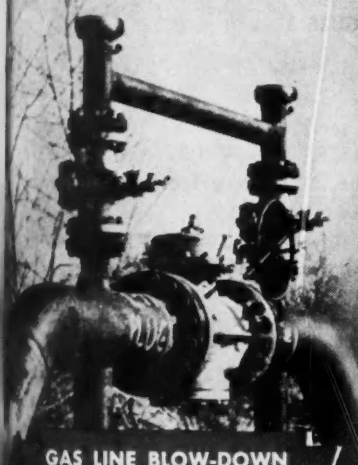

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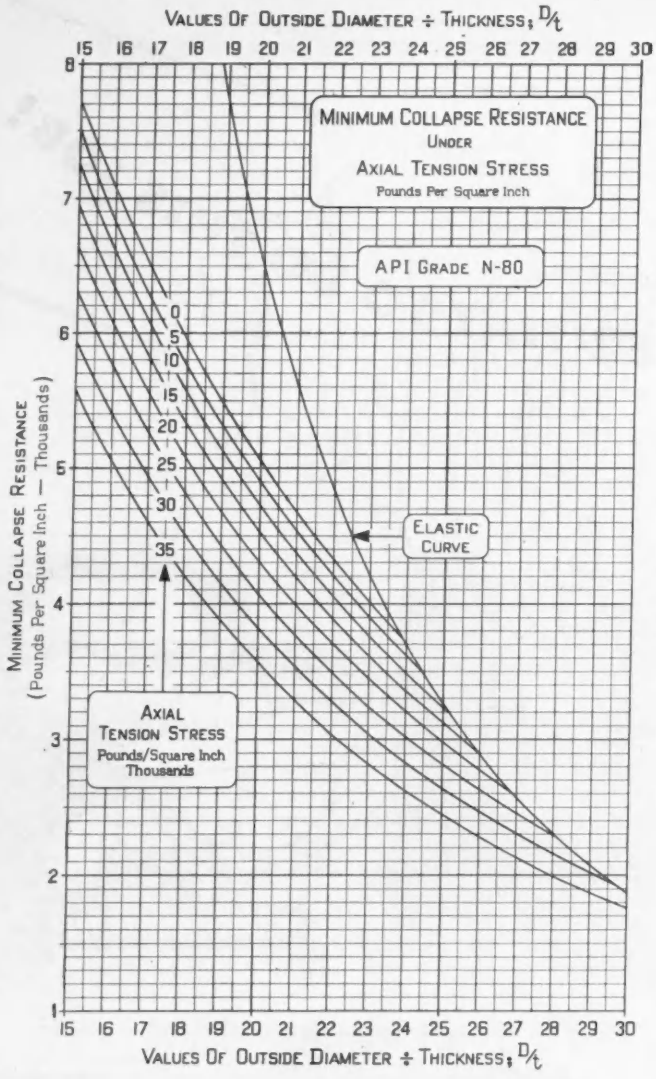

FIGURE 2

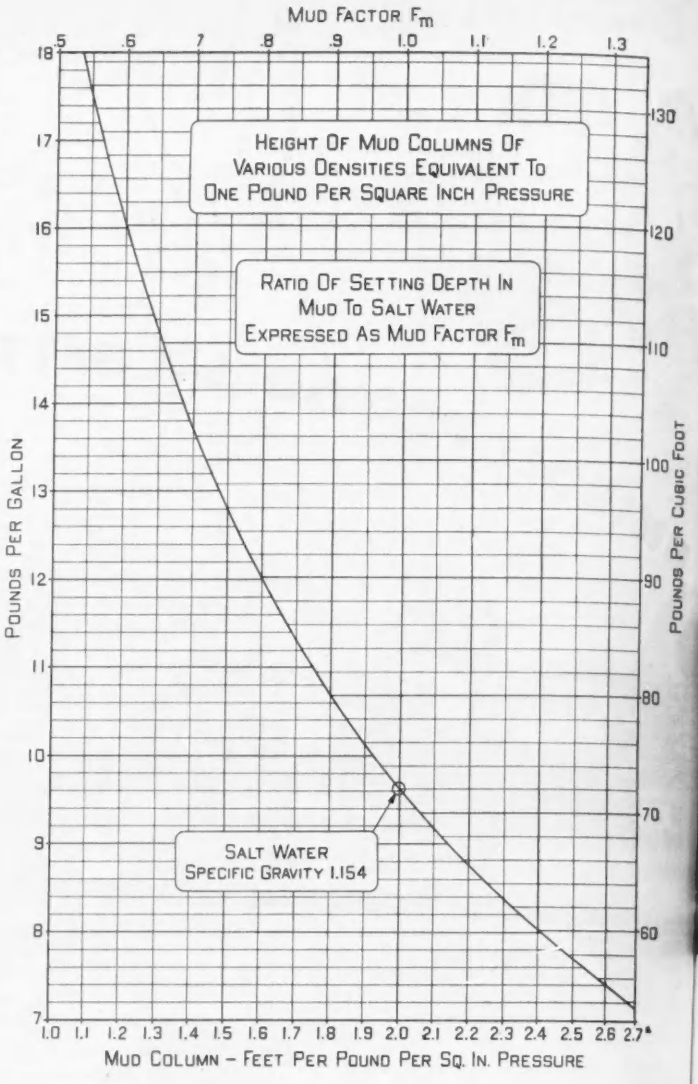
MUD FACTOR Fm
HEIGHT OF MUD COLUMNS OF VARIOUS DENSITIES EQUIVALENT TO ONE POUND PER SQUARE INCH PRESSURE
RATIO OF SETTING DEPTH IN MUD TO SALT WATER EXPRESSED AS MUD FACTOR Fm
SALT WATER SPECIFIC GRAVITY 1.154
POUNDS PER GALLON
POUNDS PER CUBIC FOOT
MUD COLUMN – FEET PER POUND PER SQ. IN. PRESSURE

FIGURE 3

feet as the maximum depth to which the 23-pound can be set under the stress from the 2350 feet of 26-pound necessary, plus the weights of the 2500 feet of 29-pound and the 950 feet of 32-pound, the total tensile load at 6200 feet on the 23-pound becomes 164,000 pounds, the unit tensile stress 24,640 psi, the resistance to collapse of seven-inch, 23-pound N-80 under this stress 3494 psi to meet a collapse pressure of 3100 psi at 6200 feet to give a safety factor of 1.127. In carrying out these step calculations for collapse, a good rule is never to design for biaxial forces at a unit tensile stress of over 35,000 psi to avoid using too light a weight of casing to handle the yield requirements of a casing string as discussed later.

String Tension

Collapse has been figured for four sections, and tension should now be considered. Using a full 6200 feet of 23-pound N-80 on top, the string weight becomes 306,600 pounds, which, multiplied by our selected safety factor requirement of 2.00, results in a joint strength requirement of 613,200 pounds. The regular non-upset API joints in Table 2 fail to meet this requirement in seven-inch, 23-pound N-80. However, the upset joints shown in Table 4 show three types of joints that will comply, namely: (long threads and couplings [LT&C], short threads and couplings [ST&C]) Light Upset, ST&C Heavy Upset, or LT&C Heavy Upset. Since the light upset long coupling has an advantage of slightly larger internal diameter, this was selected for the sample calculation. The safety factor at the top in ultimate tension becomes the minimum joint strength of the joint selected (626,000 pounds), divided by the load below the top joint of the section in question (306,600 pounds), or 2.04. Since N-80 usually is furnished with long threads and couplings, these are used in the other sections. Repeating the calculation for the other sections, the safety factor of the 26-pound section at 6200 feet becomes 2.80 (460,000 ÷ 164,000), of the 29-pound section at 8550 feet becomes 5.05 (520,000 ÷ 102,900), and of the 32-pound section at 11,050 feet becomes 19.01 (578,000 ÷ 30,400). All of these meet the 2.00 safety factor requirement in ultimate tension.

The minimum yield strength safety factor should never be less than 1.25. For upset material the minimum plain end yield strength should be considered and, for ease of calculation, the product of the plain end area times the minimum yield strength has been predetermined and listed in the next to the last column of Table 4. For non-upset casing, the minimum yield strength of the area under the last engaged thread should be obtained by multiplying the minimum yield strength (80,000 psi for N-80) by the area under the last thread which is shown in the last column of Table 5. The product of these divided by the weight being held by the top joint of the section in question becomes the safety factor in minimum yield strength. Thus, these safety factors become 1.73 at the top (532,000 pounds ÷ 306,600 pounds), 2.92 at 6200 feet (5.998 × 80,000 ÷ 164,000) 5.36 at 8550 feet (6.899 × 80,000 ÷

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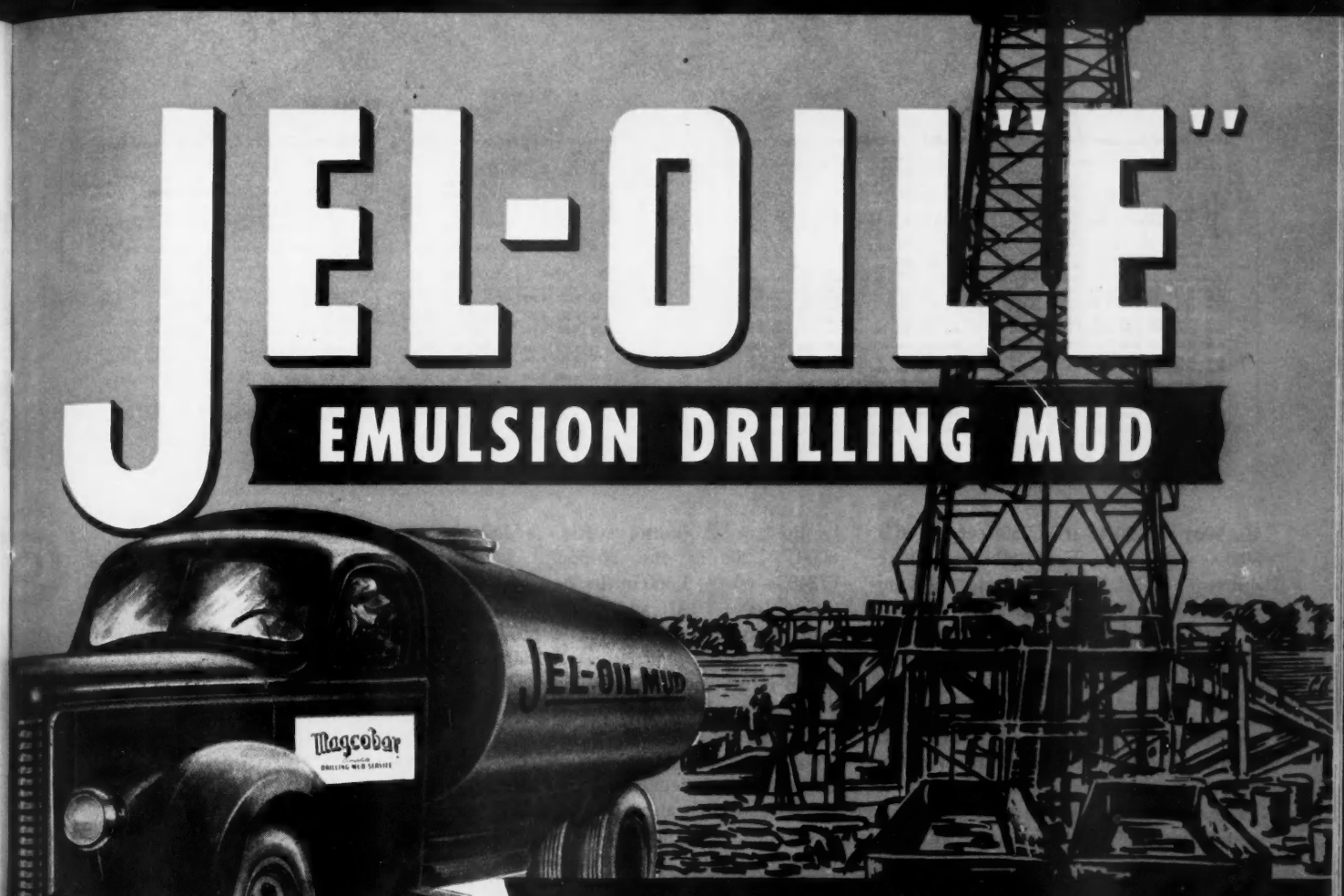

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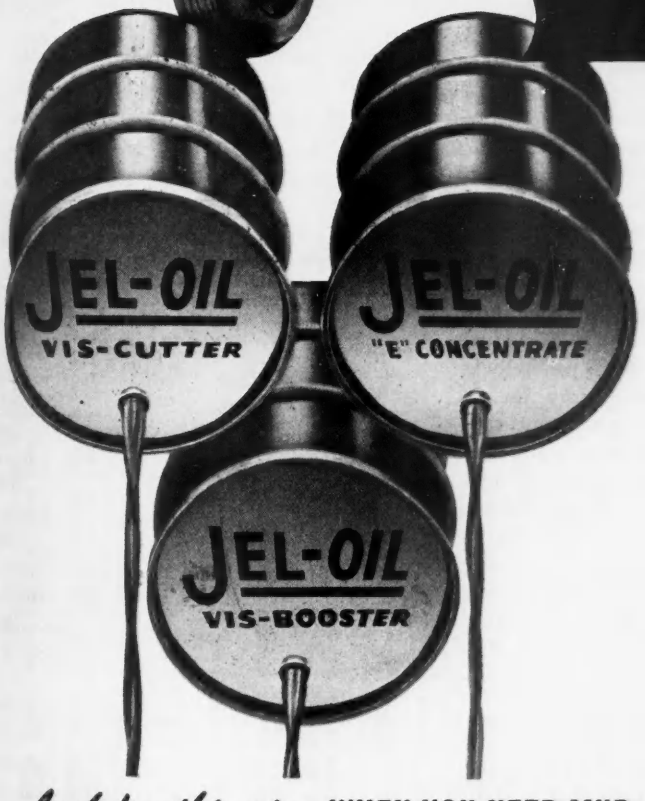

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TABLE 2

Dimensions and Properties—NATIONAL ◈ SEAMLESS API CASING—Non-Upset

Size: outside diameter	Nominal weight per foot, threads and coupling	Plain end	Wall thickness	Inside diameter	Drift diameter	Coupling: Outside dia. API (Non-upset and Upset)	Coupling: Outside dia. Special clearance (Non-upset)	Coupling: Length	Steel grade	Collapse: Setting depth	Tension based on min. properties: Short coupling Length	Short coupling Joint (min.)	Long coupling Length	Long coupling Joint (min.)	Internal pressures: Mill test	Yield (min.)	Ultimate Min.	Ultimate Avg.
Ins.	Lbs.		Ins.							S.F. 1½ Ft.	Ft.	1000 Lbs.	Ft.	1000 Lbs.	PSI			
7	17.00	16.79	.231	6.538	6.413	7.656	7.375	7½	J	1000	3470	116	...	...	1200	1440	3300	3630
	17.00	16.79	.231	6.538	6.413	7.656	7.375	7½	H	3440	4710	160	...	...	2100	2310	4460	4900
	20.00	19.94	.272	6.456	6.331	7.656	7.375	7½	...	3410	4750	191	...	...	2500	2720	5250	5830
	20.00	19.94	.272	6.456	6.331	7.656	7.375	7½	J	4440	6300	254	...	...	2000	2740	6960	7770
	23.00	22.63	.317	6.366	6.241	7.656	7.375	7½	N	7540	6530	300	7030	344	3000	4380	7450	8320
	20.00	19.94	.272	6.456	6.331	7.656	7.375	7½	H	7040	7010	333	6700	400	3000	4340	6960	8000
	23.00	22.63	.317	6.366	6.241	7.656	7.375	7½	N	9460	8960	426	8960	426	4000	5780	8930	10240
	26.00	25.59	.362	6.276	6.151	7.656	7.375	7½	J	7220	6836	245	7030	306	3000	4980	6510	10240
	26.00	25.59	.362	6.276	6.151	7.656	7.375	7½	N	9460	7730	402	8960	402	3000	7240	10800	11380
	29.00	28.72	.408	6.184	6.059	7.656	7.375	7½	N	11320	7030	464	8970	529	3000	8160	11540	12820
	32.00	31.68	.453	6.094	5.969	7.656	7.375	7½	N	13160	7030	526	8970	670	3000	9080	12820	14240
	35.00	34.59	.498	6.004	5.879	7.656	7.375	7½	N	14970	7030	584	8970	655	3000	9980	14060	15620
	38.00	37.25	.540	5.920	5.795	7.656	7.375	7½	N	16140	7030	600	8960	685	3000	10800	15270	16970

National Tube Company

TABLE 4

Dimensions and Properties—NATIONAL ◈ SEAMLESS API CASING—Internal Upset

Size: outside diameter	Nominal weight per foot, threads and coupling	Light upset: Short and long: Inside diameter Drift	Light upset: Short and long: Inside diameter Upset	Light upset: Ultimate joint strength: Short coupling Min.	Light upset: Ultimate joint strength: Short coupling Avg.	Light upset: Ultimate joint strength: Long coupling Min.	Light upset: Ultimate joint strength: Long coupling Avg.	Steel grade	Collapse: Setting depth S.F. 1⅛	Heavy upset: Short coupling: Inside diameter Drift	Heavy upset: Short coupling: Inside diameter Upset	Heavy upset: Short coupling: Ultimate joint strength Min. Avg.	Heavy upset: Long coupling: Inside diameter Drift	Heavy upset: Long coupling: Inside diameter Upset	Heavy upset: Long coupling: Ultimate joint strength Min.	Heavy upset: Long coupling: Ultimate joint strength Avg.	Plain end strength: Yield (min.)	Plain end strength: Ultimate (min.)
Ins.	Lbs.	Ins.		1000 Lbs.					Ft.	Ins.		1000 Lbs.	Ins.		1000 Lbs.		1000 Lbs.	
7	20.00	6.331	6.362	406	510	...	...	J	4440	6.241	6.273	468	565	...	...	...	...	316	615
	23.00	6.241	6.273	468	565	537	671	J	6890	6.151	6.184	627	659	6.151	6.184	656	756	365	712
	23.00	6.241	6.273	545	681	625	782	N	7540	6.151	6.184	614	767	6.151	6.184	704	800	532	795
	20.00	6.151	6.184	527	659	605	756	J	7220	6.059	6.094	596	732	6.059	6.094	672	840	415	808
	26.00	6.151	6.184	614	767	704	880	N	9460	5.969	6.005	749	936	6.059	6.094	782	978	604	966
	29.00	6.059	6.094	662	892	762	978	N	11320	5.879	5.916	814	1018	5.969	6.005	959	1074	676	972
	32.00	5.969	6.005	749	936	859	1074	N	13160	5.795	5.834	874	1082	5.879	5.916	934	1168	748	1071
	35.00	5.879	5.916	814	1018	934	1168	N	14970	5.499	5.538	1085	1356	5.795	5.834	1003	1254	814	1170
	38.00	5.795	5.834	874	1082	1003	1254	N	16140	...	...	...	...	...	...	...	...	877	1260

Oil Country Tubular Products

102,900) and 20.43 at 11,050 feet (7.766 × 80,000 ÷ 30,400). These all meet the requirement of 1.25 safety factor in minimum tensile yield strength.

In figuring the safety factors for internal yield pressure, it is felt that these should never be less than one or unity where bottom hole pressures can be reasonably anticipated and should be raised where high abnormal pressures may be found. It is usual practice to assume the internal pressure as being equivalent to the collapse pressure at the bottom, which in this case of 9.62 pounds per gallon mud, would be 6000 psi. However, if the formation pressure is known this value should be used. The minimum internal yield pressure capable of being withstood by each size and grade of casing is listed in the next to last column of Table 2. The safety factor in internal yield pressure is the listed minimum internal yield pressure of the casing divided by the internal pressure to become 1.056 in the top 23-pound section (6340 ÷ 6000) 1.206 in the 26-pound section (7240 ÷ 6000), 1.360 in the 29-pound section (8160 ÷ 6000) and 1.510 in the bottom 32-pound section (9060 ÷ 6000). All these meet the requirement of 1.00 safety factor in internal yield pressure.

This completes the design under the conditions selected. Had another mud weight and safety factor in collapse been encountered, it would not be possible to conveniently use the listed setting depths in collapse in Table 2. Instead of the procedure used in the beginning, where the bottom section was selected through the listed values of setting depth in collapse in Table 2, the bottom section is determined by figuring the collapse pressure exerted by the mud column, multiplying by the safety factor, and exceeding the product of this multiplication in Table 3 under the column headed zero stress, since the bottom section is being considered. As an illustration of developing the bottom section, assume that 10.7 pounds per gallon mud (80 pounds per cubic foot) was required and the safety factor desired in collapse was 1.25. From Figure 3 select the mud column-feet per psi for the 10.7 pounds per gallon mud which is 1.8. Dividing this into the depth (12,000 feet) gives the collapsing pressure at the bottom as 6667 psi, which, when multiplied by the safety factor, (1.25) gives a casing requirement that must exceed 8333 psi under zero stress in Table 3. The bottom section under these conditions would have been seven-inch, 35-pound N-80. In the upper sections a similar procedure is involved as discussed under the original conditions except that collapsing pressures are figured on the new mud weight and the aim is at the new safety factor.

Shorter Strings

In designing shorter combination strings it is often the case that a short thread and coupling section lies between two sections of long threads and couplings. This imposes a cross-over problem which can be readily handled with an additional long coupling. In this, no consequence is made where a short casing thread would be screwed into the long coupling. However, where a long casing thread goes into a joint equipped with a short coupling it is necessary to remove the short coupling and replace with a long coupling before stabbing and making up the joint. Both connections have the same thread elements with the exception of thread length, and a long thread screwed into a short coupling may meet the opposite pipe end in the center of the coupling, thereby blocking the proper makeup of the connection.

Where bottom open hole clearance is a problem, special clearance couplings can be used (Column 8, Table 2). These develop 90 percent of the listed ultimate joint strengths but require reasonable care in handling to prevent their being knocked out of round.

Similar data for other sizes and grades than that presented here are available in publications of casing manufacturers.

TABLE 3

National Tube Company

MINIMUM COLLAPSE RESISTANCE UNDER AXIAL TENSION STRESS

API GRADE N-80

Size: outside diameter D	Wall thickness t	Weight per foot T.&C.	D/t	Plain end area	Unit tensile stress—psi thousands 0	5	10	15	20	25	30	35
Ins.	Ins.	Lbs.		Sq. ins.								
4½	.250	11.60	18.000	3.338	5930	5750	5560	5330	5080	4820	4520	4210
4½	.290	13.20	15.517	3.836	7350	7160	6930	6640	6340	6020	5670	5310
5	.296	15.00	16.891	4.374	6820	6330	6110	5870	5600	5310	4970	4980
5	.362	18.00	13.812	5.275	8550	8320	8027	7720	7360	7000	6610	6210
5½	.304	17.00	18.092	4.962	5890	5700	5510	5290	5040	4780	4480	4180
5½	.361	20.00	15.235	5.828	7560	7320	7090	6800	6490	6170	5810	5450
5½	.415	23.00	13.253	6.630	9900	8600	8430	8130	7780	7380	6980	6560
6	.288	18.00	20.833	5.168	4730	4580	4420	4240	4040	3820	3600	3340
6	.324	20.00	18.518	5.777	5690	5500	5320	5100	4850	4600	4320	4030
6	.380	23.00	15.789	6.709	7180	6960	6740	6470	6180	5860	5520	5170
6⅝	.352	24.00	18.821	6.937	5550	5380	5180	4960	4740	4490	4210	3929
6⅝	.417	28.00	15.887	8.133	7110	6910	6680	6410	6120	5810	5470	5110
6⅝	.475	32.00	13.947	9.177	8490	8210	7920	7620	7280	6920	6530	6140
7	.317	23.00	22.082	6.656	4300	4180	4040	3870	3680	3480	3280	3030
7	.362	26.00	19.337	7.549	5320	5160	4980	4770	4540	4300	4040	3780
7	.408	29.00	17.157	8.449	6370	6180	5970	5740	5480	5180	4870	4540
7	.453	32.00	15.453	9.317	7400	7210	6970	6680	6360	6040	5700	5340
7	.498	35.00	14.056	10.173	8420	8150	7870	7570	7230	6870	6470	6100
7	.540	38.00	12.962	10.959	9080	8840	8600	8340	8000	7590	7170	6740
7⅝	.328	26.40	23.246	7.519	3930	3820	3690	3540	3380	3190	2980	2780
7⅝	.375	29.70	20.333	8.541	4910	4780	4610	4420	4200	3980	3740	3470
7⅝	.430	33.70	17.732	9.720	6070	5890	5690	5470	5200	4940	4640	4310
7⅝	.500	39.00	15.250	11.192	7530	7340	7090	6790	6490	6160	5800	5440
8⅝	.400	36.00	21.562	10.336	4470	4340	4200	4030	3830	3620	3390	3160
8⅝	.450	40.00	19.166	11.567	5390	5240	5060	4840	4620	4360	4100	3820
8⅝	.500	44.00	17.250	12.763	6320	6140	5920	5700	5430	5140	4830	4500
8⅝	.557	49.00	15.485	14.118	7370	7180	6940	6650	6360	6030	5680	5320
9⅝	.396	40.00	24.367	11.454	3530	3500	3400	3280	3120	2960	2780	2580
9⅝	.435	43.50	22.126	12.559	4280	4160	4020	3860	3670	3460	3250	3020
9⅝	.472	47.00	20.391	13.572	4900	4750	4580	4390	4180	3940	3700	3460
9⅝	.545	53.50	17.660	15.547	6110	5920	5730	5500	5240	4960	4650	4340
10¾	.480	51.00	22.396	14.561	3750	3640	3520	3380	3220	3040	2860	2640
10¾	.495	55.50	21.717	15.947	4420	4290	4150	3980	3780	3570	3380	3110

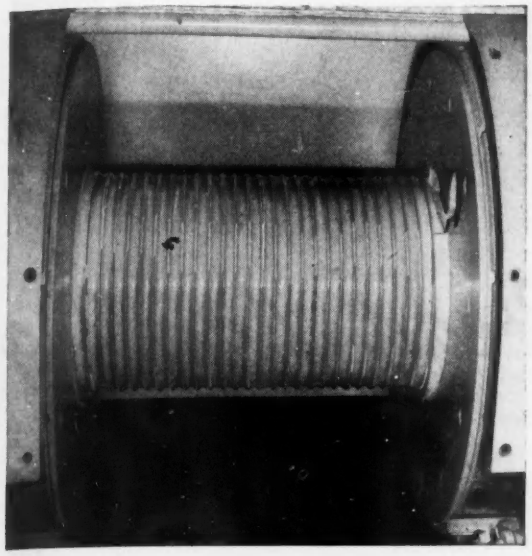
TABLE 5

National Tube Company

TRANSVERSE METAL AREAS OF NATIONAL SEAMLESS API CASING

Size: outside diameter D	Weight per foot: Threads and coupling	Weight per foot: Plain end	Wall thickness t	D/t	t/D	Plain end area	Area of root of last engaged thread in joint
Ins.	Lbs.	Lbs.	Ins.			Sq. ins.	Sq. ins.
4½	9.50	9.40	.205	22.0	.046	2.766	1.770
4½	11.60	11.35	.250	18.0	.056	3.338	2.247
4½	13.50	13.04	.290	15.5	.064	3.836	2.644
5	11.50	11.23	.220	22.7	.044	3.304	2.239
5	13.00	12.83	.253	19.8	.051	3.773	2.670
5	15.00	14.87	.296	16.9	.059	4.374	3.271
5	18.00	17.93	.362	13.8	.072	5.275	4.171
5½	13.00	12.84	.228	24.1	.041	3.776	2.581
5½	14.00	13.70	.244	22.5	.044	4.029	2.814
5½	15.50	15.35	.275	20.0	.050	4.514	3.289
5½	17.00	16.87	.304	18.1	.055	4.962	3.747
5½	20.00	19.81	.361	15.2	.066	5.828	4.653
5½	23.00	22.54	.415	13.3	.075	6.630	5.414
6	15.00	14.65	.238	25.2	.040	4.308	2.981
6	18.00	17.57	.288	20.8	.048	5.168	3.941
6	20.00	19.64	.324	18.5	.054	5.777	4.483
6	23.00	22.81	.380	15.8	.063	6.709	5.362
6⅝	17.00	16.69	.245	27.0	.037	4.911	3.446
6⅝	20.00	19.49	.288	23.0	.043	5.734	4.357
6⅝	24.00	23.58	.352	18.8	.053	6.937	5.470
6⅝	28.00	27.65	.417	15.9	.063	8.133	6.588
6⅝	32.00	31.20	.475	13.9	.072	9.177	7.710
7	17.00	16.70	.231	30.3	.033	4.912	3.361
7	20.00	19.54	.272	25.7	.039	5.749	4.198
7	23.00	22.63	.317	22.1	.045	6.656	5.155
7	26.00	25.66	.362	19.3	.052	7.549	6.098
7	29.00	28.72	.408	17.2	.058	8.449	6.999
7	32.00	31.68	.453	15.5	.065	9.317	7.765
7	35.00	34.58	.498	14.1	.071	10.172	8.622
7	38.00	37.26	.540	13.0	.077	10.950	9.403
7⅝	20.00	19.69	.250	30.5	.033	5.792	4.102
7⅝	24.00	23.47	.300	25.4	.039	6.904	5.213
7⅝	26.40	25.56	.328	23.2	.043	7.519	5.829
7⅝	29.70	29.04	.375	20.3	.049	8.541	6.888
7⅝	33.70	33.04	.430	17.7	.056	9.720	8.059
7⅝	39.00	38.05	.500	15.2	.066	11.192	9.501

S-A-V-E



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Photograph below shows how end fillers are installed and the first section of groove bar started. Size bar available for every drilling line size.

Below, right, shows continuation of wrapping process and how left end fillers are welded in. Should it be necessary to change wire line size, groove bars can be removed and new size installed in the field.

Notice the drum grooves. They're installed in the field to fit whatever size line you're using. Can be changed to fit new size line with little time and trouble. Prevents crushing first and succeeding wraps—thus makes line safer and longer lasting. When cutting line end to change wear points, line is wrapped on properly, promptly—saving time and trouble.

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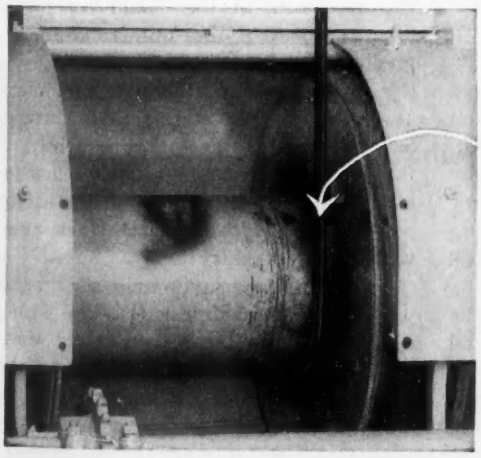

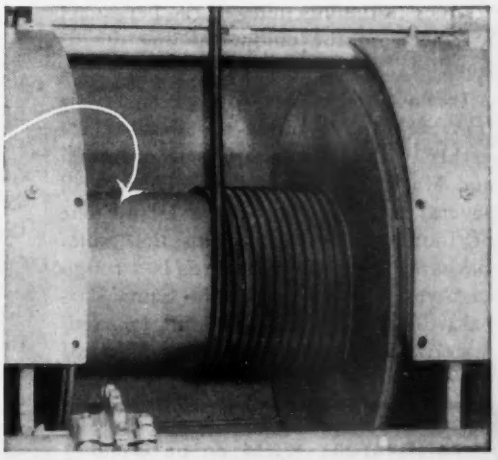

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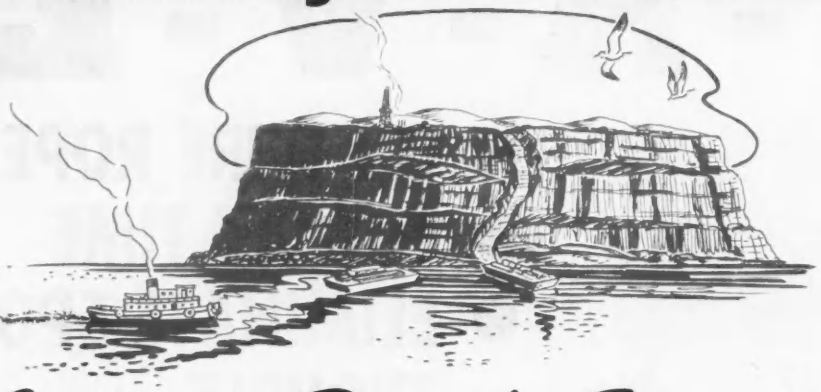
Advance Planning Solves Problems of Island Beach-Head Landing



By GILBERT M. WILSON
Staff Writer

WHEN Signal Oil and Gas Company successfully handled in routine manner the landing, beaching and unloading of sea-going barges laden with a complete drilling rig, as well as all associated equipment and camp facilities for crews on the narrow, windswept beach of an island 30 miles off the Southern California coast, it was "routine" only because of the very extensive and thorough planning by engineers and supervisory personnel.

That the landing operations were conducted without incident; and that the same equipment subsequently was reloaded on the barges without benefit of piers, cranes or usually accepted wharfing facilities after drilling operations were concluded on the island, further testifies to the ingenuity of the personnel in charge of the unique landing operations.

It was in the latter part of last year that Signal Oil, acting as operator, together with Honolulu Oil Corporation and Macco Corporation, decided to drill several tests on Santa Rosa Island, one of four islands making up the Santa Barbara group which extends in a rough east-west line parallel to the Santa Barbara Coast. Santa Rosa Island, approximately 16 miles long and perhaps half that wide, embraces an area of about 40 square miles. It is mountainous and is uninhabited except for occasional periods when cattle and sheep are grazed on the grassy table lands found in some parts of the interior. Lacking harbors and deep water loading facilities, and rimmed by steep bluffs that rise abruptly only a few feet back from mean tide water line, the island had to be approached from the open sea with flat bottom sea-going barges capable of being beached and held there during favorable tidal periods while equipment was being unloaded.

EXPLORATORY WELLS on an island unfavorable to normal material transportation were put down through extensive preliminary study and preparation of terrain for landing and transporting equipment. Techniques followed those developed and applied in wartime beach-head operations.

Two Barges Used

Two wooden barges were employed in the shipping of equipment to and from the island. The larger one, of 900-ton load capacity, was 138 feet long by 42-foot beam, and was used to carry the heavier items such as the drilling rig, pumps and certain wheeled vehicles. The smaller barge, 72 feet in length by 30-foot beam, was employed for the transportation of lighter vehicles and materials. For the initial trip to the island, the barges were loaded at San Pedro, where dock facilities and a large crane were used to assist in the loading operations.

Drilling equipment, owned by Santa Fe Drilling Company, drilling contractor for the project, was for the greater part conventional, most of it being portable and skid-mounted. Principal item was the drilling rig, a portable, trailer-mounted unit having a 96-foot telescoping, quick-lift mast. Mounted on a 30-ton trailer, the rig consisted of a torque-converter equipped air-controlled hoist powered by a 300-horsepower twin diesel engine. Rated depth of the unit is 6500 feet, using 4½-inch drill pipe. The mud pump was a 7¼ x 12 unit powered by a torque converter-equipped twin diesel engine. Accompanying this equipment was the usual complement of tools, drill pipe, casing, cement, and rigging materials, as well as the various supplies needed to set up camp for crews and personnel quartered on the island. Much of the equipment loaded at San Pedro was placed aboard semi-trailers; these units were then swung aboard with a large crane mounted on the wharf.

Trailers greatly simplified and speeded the unloading at the island beach and later removal of the units to the intermediate base on the bluff. Time was of the essence in the unloading operations at the beach, for strong tidal currents and stiff winds, the latter frequently attaining velocities as high as 60 miles per hour, made it imperative that the barges be beached, unloaded, and taken away without unnecessary delay.

It required approximately six trips to deliver all the equipment to the island, three with the large barge and three with the smaller one. Semi-trailers, unloaded atop the bluff at the intermediate base, were returned on the empty barges each trip for reloading at San Pedro.

Two or three months prior to the actual landing of equipment on the beach, crawler-type tractors and road building equipment were taken to the island to build roads, clear locations, clear an airplane landing strip atop the bluff, and prepare the beach for the landing of barges.

Advantage was taken of part of an

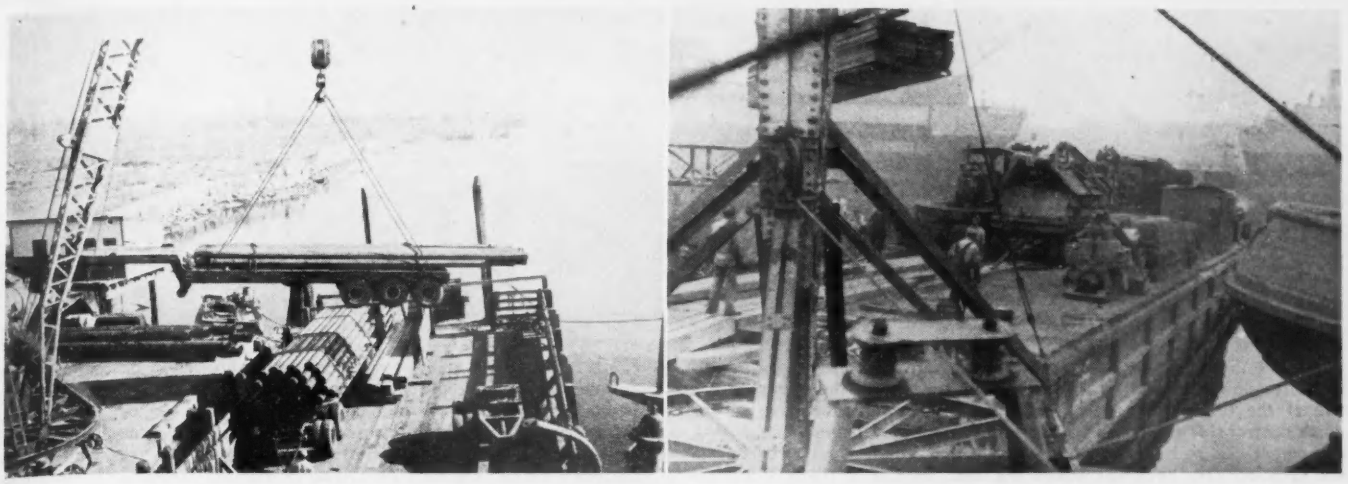


FIGURE 1. Loading of the two sea-going barges took place at San Pedro. The 110-mile trip from there to the island, after some delays caused by bad weather, required about 30 hours. Vehicles and trailers were loaded, backed on, or lifted on to the barge and lashed down to the deck. When the drilling rig was backed on, the truck-tractor was pulled away, and while a crane held up the front end of the trailer, an eight-wheeled dolly was rolled under the gooseneck. Use of this dolly greatly facilitated subsequent unloading and transporting of the heavy rig on the island. Semi-trailers with casing and other heavy equipment were similarly equipped for simplified hauling.

old road that had been built by Standard Oil Company of California when that company, in 1932, drilled an unsuccessful test on the island. This road was partially repaired and used to some extent by the Army during the war when a radar station was maintained on the island.

A small pier, situated near the beach landing site, and which was used by Standard to unload equipment when its well was drilled, was too weakened to be of service in the present operations other than to serve as support for a small pipe line used to transfer diesel fuel from the shore boat to a supply tank mounted on the shore.

30-Hour Trip

The 110-mile trip from San Pedro to the island required about 30 hours. Communication between the island operations and the company's Los Angeles headquarters office was maintained with convention ship-to-shore radio telephone. Short wave radio was used extensively between the island and small boats, tugs

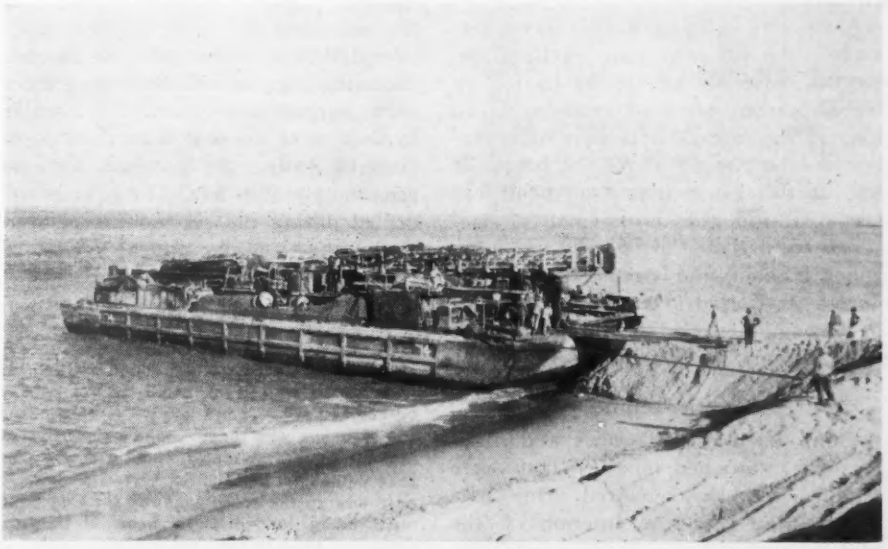


FIGURE 2. Prior to the actual beaching of the barges, bulldozers built up a sand ramp, the top of which, reinforced by planking and steel airplane landing strip material, was brought up level with the barge deck. The tug boat brought the barge in as far as possible, after which bulldozers, pulling on manila hawsers run through snatch blocks tied to buried deadmen, warped the barge up to the beach. The use of snatchblocks permitted the bulldozers to make their run up the narrow beach. Two additional lines were tied to the stern and also anchored on shore, this precautionary move assuring that the seaward end of the barge would not be shifted by tidal action and the sometimes gale-velocity winds prevailing in the area. The barge was brought up and beached at high tide so that as the tide receded, the barge would rest solidly on the sand. In this view, a tractor is about to pull the 48-ton drilling rig off the barge.

★

FIGURE 3. Night fell before the first barge could be completely unloaded, and to enable completion of the job while tides were favorable, a generator on the barge was put into operation and lights were strung up on poles on the barge and beach. Everything was off the barge by daylight the next morning. Note steep bluffs and narrow, sandy beach, features which contributed to the difficulty of landing heavy equipment and towing of vehicles up to the intermediate base located on the table land visible above the first bench above the beach.

FIGURE 4. Steep grades, sharp curves and narrow passes were encountered frequently on the 14-mile, 6½-hour trip across the island to the site of the first well. Because there were no suitable beaches on the north central side of the island where the first test well was to be drilled, equipment had to be hauled across the island. Highest point reached in the cross-country haul was where the road crossed a ridge 1580 feet above sea level. Shown here is a portion of the winding road leading to the first well. Road-making was in advance of rig arrival.

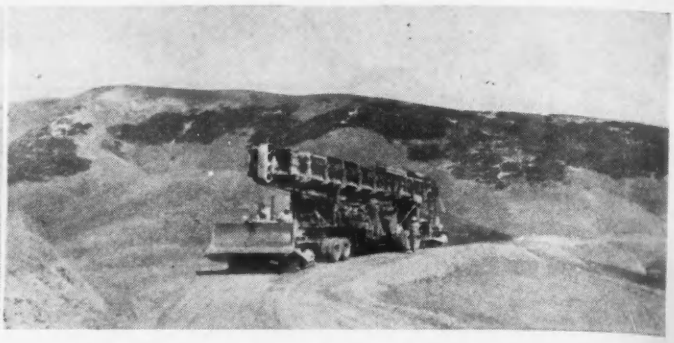


FIGURE 5. The rig unit, which under more normal circumstances can be pulled with a single truck or tractor, here had to be moved with two bulldozers, one pulling, and on the steeper grades, one pushing. To provide braking action while descending steeper grades, an air compressor was mounted on the rig, permitting the air brakes of the trailer to be operated. Brake controls were strung over to the operator of the leading tractor. Note that an eight-wheel dolly was used under the trailer gooseneck in lieu of the truck tractor.

and barges when these craft were lying offshore.

After the equipment had been unloaded, the job was only partly done, for the materials had to be hauled up the 22-percent grade of sandy surfaced road to the intermediate base of operation on the plateau above the beach. It was at this point that equipment was prepared for the cross-country haul across the island, a 14-mile trip over winding roads and steep grades. Bulldozers were used extensively to pull or push equipment while traversing the more difficult portions of the road.

Camp Facilities

Camp facilities for crews and other personnel stationed on the island were established at a converted army barracks located in the interior of the island. Drinking water for personnel was brought over from the mainland, but drilling water was developed from natural springs and delivered by pipeline to the several well sites. Crews and supplies were transported to and from the mainland by both airplane and a World War II converted mine sweeper. Electrical logging and cementing trucks were barged over from the mainland as they were needed. Maximum depths attained during the program were approximately 5000 feet. Three wells were drilled during the six months of actual exploratory activity on the island. No commercial shows of oil were found.

FIGURE 8. When the drilling program was ended, a different point was found on the island from which equipment could be reloaded on barges somewhat more easily. A very narrow, steep canyon was widened and graded, providing a straight run down which tractors could take equipment. Illustrated here is a view from part way up the steep roadway showing equipment being loaded on a beached barge. A somewhat longer ramp (not entirely visible) was required on the beach, but the nearly straight run from summit to the barge made loading operations easier than those encountered on the original landing.

FIGURE 6. Diesel oil and supplies were brought in by a converted World War II YMS minesweeper which plied between the mainland and the island. An airplane was chartered to carry supervisory personnel and drilling crew men back and forth. Four drilling crews, making up a total of 20 men, were used on the job. During the development program, men worked 12 days on, were flown to the mainland for four days off.

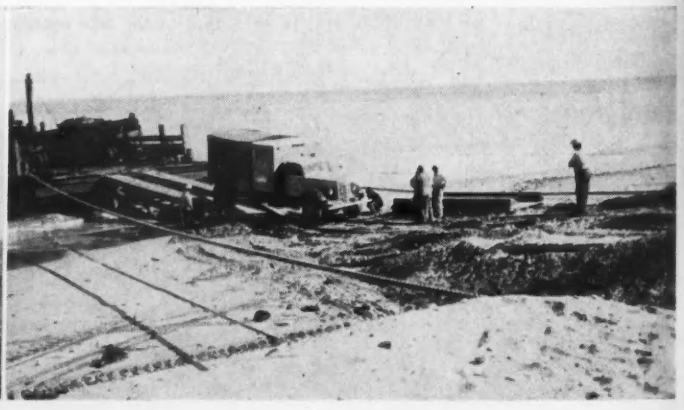


FIGURE 7. After the initial and most urgently needed pieces of equipment were brought to the island, the smaller barge was used to bring over such items as casing, and as can be seen in the above photograph, an electric logging service truck. For this smaller barge, a somewhat lighter ramp system was used. The high ramp as used for the large barge was unnecessary, a small but heavy ramp made of timbers being used.

"DUAL NH" CUMMINS DEPENDABLE DIESEL HYDRAULIC POWER UNIT

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THE CUTAWAY ILLUSTRATION SHOWS THE HYDRAULIC COUPLING AND THE AIR CLUTCH ASSEMBLY. OIL PUMPS DRAW THE OIL FROM THE BASE OF THE WELDEX CASE AND FORCE IT THROUGH THE SHAFT AND OUT PASSAGES TO THE CHAIN SPROCKET. THIS UNIT CONSISTS OF TWO SIX CYLINDER, FOUR-CYCLE CUMMINS NH-600 DEPENDABLE DIESEL ENGINES, TWO FAWICK AIRFLEX CLUTCHES, AND TWO TWIN DISC HYDRAULIC COUPLINGS.

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CUMMINS DIESEL POWER

Maintenance and Operation of Slush Pumps

FIGURE 1.

By KENNETH N. MILLS
Assistant Chief Mechanical Engineer, Emsco Derrick & Equipment Company, Houston

THE AUTHOR discusses some of the basic principles in the use of slush pumps, and lists points which, if watched, will cut down costs and extend working life of such equipment.

ONE of the major elements of cost in drilling rig operation is downtime, but some of the causes for downtime are controllable through preventive maintenance and proper operation. Preventive maintenance will disclose wear before it has caused serious damage, and it can be corrected during normal lost time periods. This practice will result in a material reduction in downtime, and it will reduce the total maintenance costs. As the slush pump is one of the key elements on a drilling rig and, due to the basic nature of its work, is subjected to adverse operating conditions, proper maintenance and operation of this machine will reduce drilling costs. It also will increase the life of expendable parts such as pistons, liners, piston rods, and valves.

Maintenance of slush pumps cannot be discussed without considering proper operation, because operating condition can have a controlling effect on maintenance costs. If the slush pump is subjected to continuous overloads for extended periods of time, its life will be materially decreased, and its maintenance costs will be excessive. Basically, all slush pumps are rated on input horsepower at a specified speed, and this rating is valid only when the pump is operating at its rated speed. If the pump speed is decreased, its input horsepower rating must be decreased proportionally. For example, if the pump is rated at 500 horsepower at 60 strokes per minute, its horsepower rating at 30 spm is 250 horsepower, and if the input horsepower at 30 spm were 500 horsepower, it would be 100 percent overloaded. The name plates on most pumps carry a pressure rating which expresses the capacity in terms which can be readily checked by the driller. This rating is the maximum discharge pressure for a given liner diameter. This pressure rating increases as the liner diameter is decreased, and is independent of operating speed. If these maximum discharge pressures are exceeded, the pump will be overloaded and the life of its power-end parts will be decreased. The amount of this decrease in life will depend on the degree of overload. The exact amount of the decrease in life is indeterminate. For moderate overloads, the life reduction will be approximately proportional to the cube of the ratio of the applied load to the rated load. For this reason, moderate overloads can cause a material decrease in pump life. Within certain limitations the pump discharge pressure can be controlled by adjusting the pump speed, as the pump speed controls the volume of fluid delivered by the pump, and therefore controls the pressure losses in the circulating system. As the circulating pressure loss varies approximately with the square of the circulating rate, a small decrease in circulating rate will cause a relatively large reduction in circulating pressure. This method of pressure control is limited by minimum desirable return velocities, engine horsepower available at reduced speeds and minimum engine speeds.

The installation of the pump can have a material effect on its operation and service life. The pump should be set level, and with its sheave parallel to and in line with the driving sheave. It should be fitted with adjusting devices similar to those shown in Figure 1 to assure proper belt tension and maintenance of drive alignment. If the sheaves are not in proper alignment, the life of the driving V-belts will be reduced because the load will not be uniformly distributed between the belts, and some of the belts will be overloaded. The V-belts should not be overtightened as slight inequalities in the lengths of the various belts will equalize under load. If the V-belts are run too tight, they will wear at an excessive rate, and this load may cause the pump pinion and drawworks bearings to fail prematurely. If the loads caused by excessive belt tension are sufficiently great, they ca

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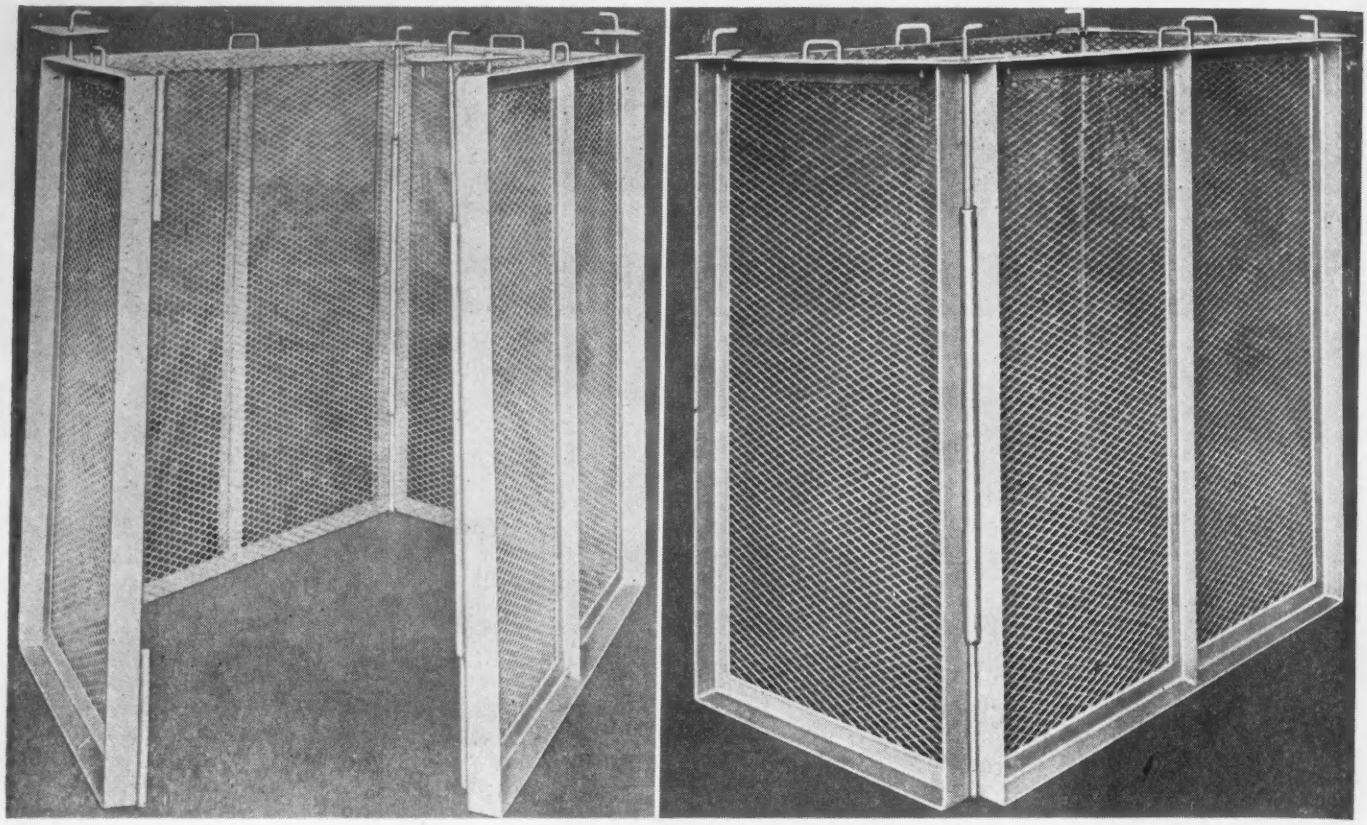


Figure 2. Suction strainer, opened (left) and closed.

cause shaft failures on both the pump and drawworks.

To decrease the possibility of fluid knocks due to starved suction, the pump should be located close to the slush pit and as low as possible. The suction pipe or hose should be at least the full size of the suction opening on the slush pump and it should have a uniform slope to the slush pump to eliminate air pockets. If it is necessary to make turns in the suction line, extra long sweep fittings should be used and valves placed in the suction line should be of the full opening, straight flow type. If an unusually long suction line is used, it is advisable to increase its size. This will decrease the pressure loss in the suction line and help prevent fluid knocks, which are undesirable because they decrease the life of fluid-end parts and subject the power-end to shock loads.

Valve trouble caused by sticks and trash from the slush pit can be decreased by fitting the suction line with a strainer. It is preferable to place the strainer in the slush pit to keep the pressure loss through the strainer at a minimum. The area of the openings in the suction strainer should be several times the total area of the suction line. An ingenious suction strainer with a very large total area is shown in Figure 2. This strainer is placed on the bottom of the pit, and the suction line is placed in the center of the top opening. Due to the oversized area and resultant low velocity into the screen the strainer can be operated for long periods without clogging. If it should become clogged, the cause for lack of fluid from the pump is immediately apparent, because the mud level within the screen will drop. As the four sides are held together with pins, it is easily removed for cleaning and reinstallation.

Avoid Prolonged Operation

Prolonged operation of a slush pump with fluid knocks will cause excessive maintenance costs and should be avoided. Fluid knocks subject the pistons and valves to very high instantaneous pressures which materially reduce life of the parts, and as these same loads are imposed on the power end of the pump they cause a reduction in its life. These knocks can be caused by the following conditions in addition to those previously mentioned:

1. Fluid cut valves.
2. Insufficient valve lift due to obstruction in upper guide.
3. Valve not seating due to worn valve or defective guide.
4. Excessive spring load on suction valve.
5. Air leak in suction line.
6. Very loose pressure sealing piston rod packing.
7. Accumulation of sand in suction line partially blocking suction line.
8. Piston loose on piston rod.
9. Excessive speed or very hot mud.

The relationship between speed and fluid knocks is rather complex as it is influenced by the pressure loss in the entire suction system. The pressure loss in the suction system is a function of the mud properties, and it increases as the mud weight is increased. With properly designed short suction lines and light muds, all pumps can be operated at their rated speed without producing fluid knocks. As the length of the suction line is increased or the mud weight increases, it may be necessary to adjust pump speed downward to reduce the intensity of fluid knocks, as this will decrease the velocity and therefore the pressure loss in the suction line. The use of steel mud tanks and flooded suctions will decrease this effect, as the flooded suction increases the mud pressure in the fluid end and helps filling. As mud is composed of water, increasing the temperature of the mud increases its vapor pressure and increases the tendency for steam to be formed in the suction system. The effect of temperature on suction lift for clean water at sea level is illustrated by Figure 3. In this chart it will be noted that the suction lift decreases as the water temperature increases. This indicates that suction losses must be kept at a minimum when pumping hot mud and that there is a definite maximum temperature beyond which mud cannot be pumped.

Proper maintenance and installation of pistons can have a material effect on pump operating costs. The piston head and piston rod tapers must be cleaned

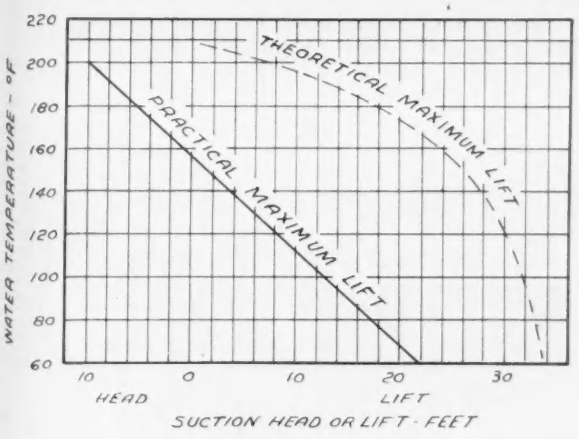


FIGURE 3.

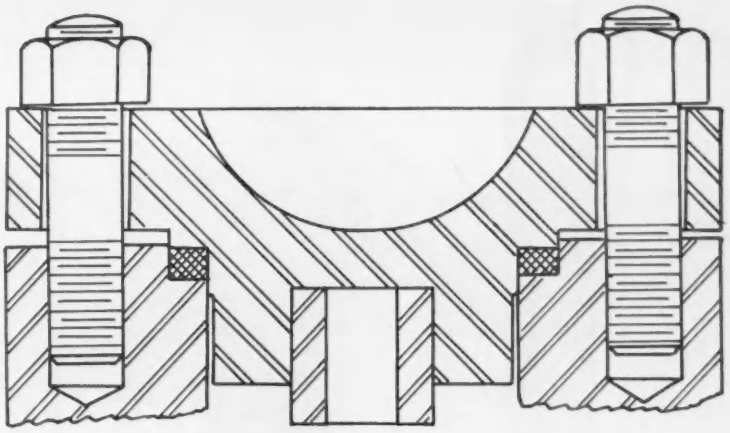


FIGURE 5.

before installing the piston head on the rod. The piston head should be driven up tight on the rod before the nut is tightened. This practice will help prevent the piston becoming loose on the rod. If an old piston is installed in a pump, its sealing lips should be inspected for cuts. If a cut piston is used, the fluid will pass through the cut at a very high velocity and this high velocity fluid will start a cut in the liner. Once a cut is started in the liner, its size will increase rapidly, and it will cause cutting of the piston. Pistons which are worn non-uniformly should be discarded. If they are used the center steel backup ring may bear on the liner. If this steel ring bears on the liner, it will scour the liner, causing it to become very rough. Once a liner becomes scored or cut it is worthless, because it will abrade piston rubbers at an accelerated rate.

Piston rod life and piston rod packing maintenance can be controlled by proper operation and careful adjustment. The piston rod packing gland tension should be sufficient only to prevent leakage. Excessive gland tension will create excessive friction, and the heat developed by this friction will burn the packing and increase the susceptibility of the piston rod to scoring. The use of oil as a piston rod washing medium reduces the friction loss in the packing, and materially increases the service life of the rod and packing. If the pump is fitted with a bolt-type gland, the nuts must be tightened down evenly. If they are not tightened down evenly, one stud will carry more than its share of the load, and the gland may drag on the piston rod as shown in Figure 4. If the load distribution between studs is not approximately equal, gland stud failures will occur. If the gland drags on the piston rod, the piston rod will wear at an excessive rate, and this will cause excessive rod and packing expense.

When replacing cylinder heads and valve pot covers, the packing should be inspected for cuts and replaced if damaged. The cover nuts should be tightened down uniformly to assure that each stud carries its portion of the load. If one nut is tightened before the others are in snug contact with the cover, it may become cocked as shown in Figure 5. This will cause the load to be applied eccentrically to the cover studs and the first stud to be tightened will fail. If the studs are tightened down evenly and gradually, each stud will carry its share of the load and stud failure will be kept at a minimum.

Periodic checking of the tightness of all bolts in the power end will help prevent expensive power end repairs caused by loose connections. If the power end develops excessive noise, the condition of its bearings and the tightness of all bolts and screwed connections should be checked. If the noise is caused by worn roller bearings, both the inner and outer race assemblies of the bearing should be replaced. Due to the design of some roller bearings, it is impossible to inspect both races without destroying the bearing. In some instances some of the exposed bearing parts will show signs of failure as evidenced by pitting, and the appearance of other parts will be good. In cases of this type some operators replace only that portion of the bearing showing visual damage. This practice is very expensive because the exposed parts which do not show damage usually are damaged and contain microscopic cracks. Also the unexposed parts may be severely pitted. In any event the life of this bearing assembly will be very short, and it will be necessary to replace the entire bearing after a relatively short period of operation.

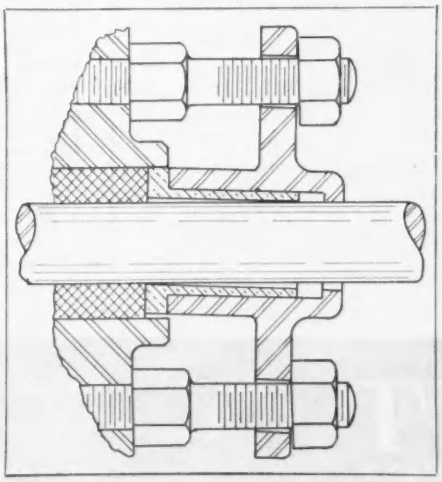
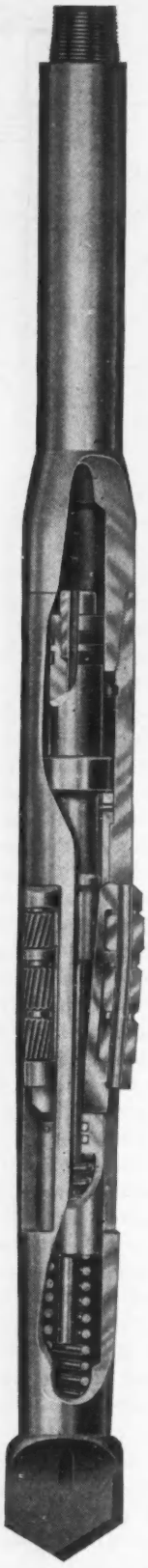


FIGURE 4.

Proper lubrication is one of the prime factors influencing power end maintenance. The manufacturer's recommendation for grade of oil should be followed, and the oil should be changed at regular intervals. If the pump is operating in a humid area it may be necessary to change the oil after only a few months service to remove the water which accumulates from condensation in the power end. In dry areas where condensation is not a problem, the oil should be changed at least once each year to remove the products of oil oxidation from the power end. These oxidation products are mild acids, and they will attack the bearings and gears and reduce their service life if not removed. Each time the oil is changed, the power end should be flushed out with crankcase flushing oil to remove the products of normal wear. Wear resulting from moisture and oxidized lubricants can be decreased by using a lubricant which contains a corrosion inhibitor. However, the use of a lubricant of this type will not eliminate the necessity for changing oil.

When the rig is stacked, the pump should be conditioned to resist corrosion. The fluid end should be thoroughly cleaned of mud and all machined surfaces should be coated with heavy grease. The piston rod extension or oil rod should be coated with heavy grease to protect it from corrosion. The power end should be opened and cleaned. After it is thoroughly cleaned of sludge and all bearings, gears and wearing surfaces should be coated with a heavy rust-preventing oil. This oil should be soluble in the normal operating oil to eliminate the necessity for recleaning the power end when the pump is placed back in service.



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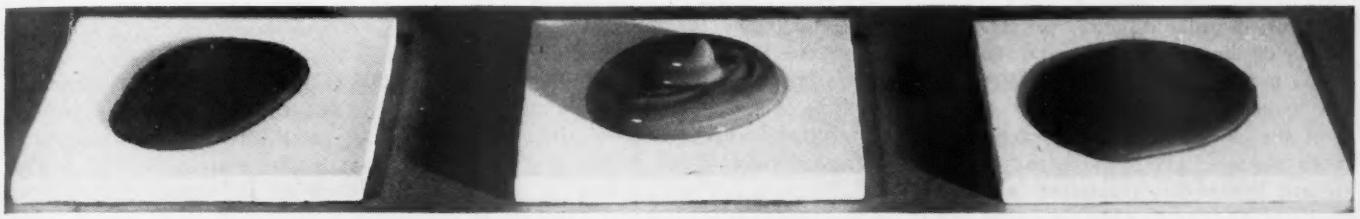
Controlling Anhydrite Contamination



in Rocky Mountain Drilling Muds

By D. D. VARNELL and W. B. KIMBRELL
Baroid Sales Division, National Lead Company

ANHYDRITE or gypsum (calcium sulfate) is encountered in the Red Bed section throughout the Rocky Mountain region in amounts ranging from a series of thin stringers to thick massive sections. The quantity of calcium sulfate is always sufficient to saturate a drilling mud system.

Two types of chemical treatment are in general use for removing the contaminating calcium sulfate from the mud. The first precipitates both the calcium and sulfate ions as well as the treating chemical. The second precipitates only the calcium, leaving the sulfate as soluble sodium sulfate. Sodium sulfate has much the same effect upon mud as a like concentration of sodium chloride. Where appreciable amounts of calcium sulfate are encountered, the second type of treatment results in a sodium sulfate concentration buildup sufficient to nullify the effects of further treatment with this second group of treating chemicals. Most of the wells drilled in the Rocky Mountain area will encounter enough calcium sulfate to reach the point where continued use of this group of chemicals is ineffective in mud control.

The problem of overcoming calcium sulfate contamination is further complicated by rather unusual drilling conditions. The overlying formations contain low pressure zones which are a constant threat from the standpoint of lost circulation. This means that the effective hydrostatic head of the mud column must be kept low. Consequently, any marked increase in mud circulating pressure, brought about by increased gels or viscosity, will cause immediate loss of circulation. This condition requires that any corrective treatment must be capable of maintaining low gel strengths and viscosity at all times.

DECREASE in viscosity and sharply increased fluid loss as calcium contamination from either gypsum or anhydrite is encountered have added to the problems of drilling throughout the Rocky Mountain area wherever the Red Beds are penetrated. The authors briefly survey palliative means, and outline programs whereby mud conditions may be stabilized in the presence of such contaminants.

The problem of maintaining close control over viscosity and gel strengths is especially difficult due to the character of the formations overlying the Red Beds, as these formations are almost completely free of contaminants and contain a large percentage of high yield colloidal clays. The resulting muds closely approximate the low mud weight required to combat loss of circulation: that is, they consist of a high percentage of colloidal clays which give viscosity and low water loss and a low percentage of inert materials which contribute nothing but weight increase to a mud. Unfortunately the colloidal clays are flocculated and thickened by the subsequent calcium sulfate contamination, so that the muds are greatly affected by the contaminant.

Pictured above are (left) flow characteristics of a normal uncontaminated drilling mud.

(Center) Flow characteristics of same mud contaminated with anhydrite.

(Right) Flow characteristics of same mud treated with $BaCO_3$.

In the past few years, several treatments have been developed for handling calcium sulfate contamination. Those that have been tried and the results obtained, under Rocky Mountain conditions, are summarized as follows:

Barium Carbonate

Barium carbonate ($BaCO_3$), the treatment most widely used, reacts with calcium sulfate to form barium sulfate and calcium carbonate, which are relatively insoluble. Thus both the contaminating and treating chemicals are precipitated. As a result, the mud may be returned to its original condition, thus allowing any amount of calcium sulfate to be removed by continued treatment.

Barium carbonate does not affect the viscosity and gel strength of the mud to which it is added, if there is no calcium sulfate then present. This characteristic permits a heavy pretreatment of the mud when anhydrite or gypsum is expected. The barium carbonate in the mud reacts with any calcium sulfate encountered, thus keeping the contaminant removed, preventing flocculation and thickening of the mud and the dangers associated with such conditions.

Because of the small amount of barium carbonate in solution at any one time, the treatment is sometimes slow, and occasionally, where anhydrite is drilled at a fast rate, the calcium sulfate contamination may accumulate faster than it is removed, resulting in temporary flocculation or thickening. If the mud becomes thick, the reaction may be retarded further due to the lack of proper agitation in a normal circulating system. However, the thickening effect may be overcome by treating the mud

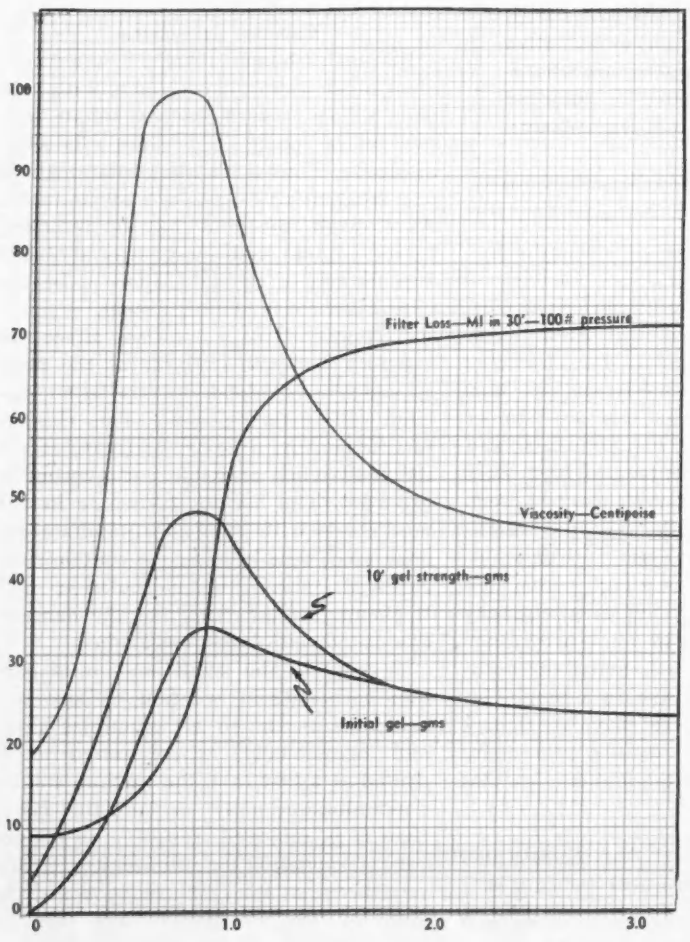
with a thinner made up of equal parts of caustic soda and quebracho. The amount of this thinner needed to give good fluidity to the mud usually results in the mud having a pH of 9.0 to 9.5. Barium carbonate is added at the same time in quantities sufficient for complete removal of the calcium sulfate. The caustic soda and quebracho solution keeps the mud thin in the presence of low concentrations of calcium sulfate, until the barium carbonate reaction can catch up with and remove the calcium sulfate. When this treatment is applied properly the mud remains in a good fluid condition with no increase in filter loss. This treating method is satisfactory where a minimum filter loss of 6 cc. API is adequate.

Soda Ash

Soda ash (sodium carbonate—Na_2CO_3) was one of the first treatments used and its effectiveness is due to the fact that the calcium combines with the carbonate, precipitating calcium carbonate. However, the sodium is left in solution in the form of sodium sulfate. The sodium sulfate in small concentrations has much less detrimental effect than calcium sulfate, so that the result of the initial treatment is elimination of flocculation. Soda ash does a very good job of treating a mud where small amounts of calcium sulfate are present, but due to the continued build-up of the sodium sulfate concentration, the mud never completely returns to its original condition. Each time the mud becomes contaminated the corrective treatment becomes less effective. After drilling large sections of anhydrite, the sodium sulfate concentration becomes as detrimental as untreated calcium sulfate.

In a few areas the amount of calcium sulfate encountered may not be sufficient to give a detrimental buildup of sodium sulfate. However, this condition is so rare that soda ash is not considered to be a satisfactory treating chemical. If soda ash is used until the sodium sulfate builds up to a high concentration, any further calcium sulfate contamination must be handled by some other method. These other treating methods generally do not reflect any benefit from the previous soda ash treatment.

The complex phosphates, like soda ash, have not been used extensively. They offer the same disadvantages in that the calcium is removed in the form of calcium phosphate and sodium sulfate is left in solution. The phosphates have some advantage over soda ash in that they are also mud thinners, but the difference is not great enough to be noticeable under field conditions.



SOLUBLE ANHYDRITE—POUNDS PER BARREL OF MUD.

Effect of anhydrite contamination on Rocky Mountain muds.

Lime-Quebracho—Pretreated Starch Mud

Lime base — pretreated starch—muds are becoming increasingly popular in special areas because of their low filter loss properties and ability to withstand calcium sulfate contamination without other corrective treatment. The treatment consists of converting the high-yield sodium-base clay by the addition of hydrated lime [$Ca(OH)_2$] to the mud. Calcium-base clays are not flocculated by calcium sulfate contamination and consequently do not show viscosity and gel strength increases when anhydrite or gypsum is drilled. The initial conversion treatment causes a temporary flocculation of the high yield clays in the mud so that careful pilot testing is necessary to determine the treatment which will give minimum thickening during the breakover or conversion period. Caustic soda and quebracho solutions are used in the conversion as a thinner and an aid in maintaining a low filter loss, thus lessening the quantity of pretreated starch needed. This type mud has a low cost advantage and is especially adapted to areas where a filter loss in the range of 1 to 6 cc. API is desired.

Lime-Lignin Extract Mud

Lime-lignin extract muds have the same desirable characteristics as lime-quebracho muds. They differ mainly in that lignin extract is used as the breakover chemical instead of quebracho. They will handle calcium sulfate without flocculation trouble and the filter loss can be controlled between 12 to 20 cc. API without pretreated starch. With the addition of pretreated starch, this mud will meet requirements where filter losses in the 1 to 6 cc. API range are desired.

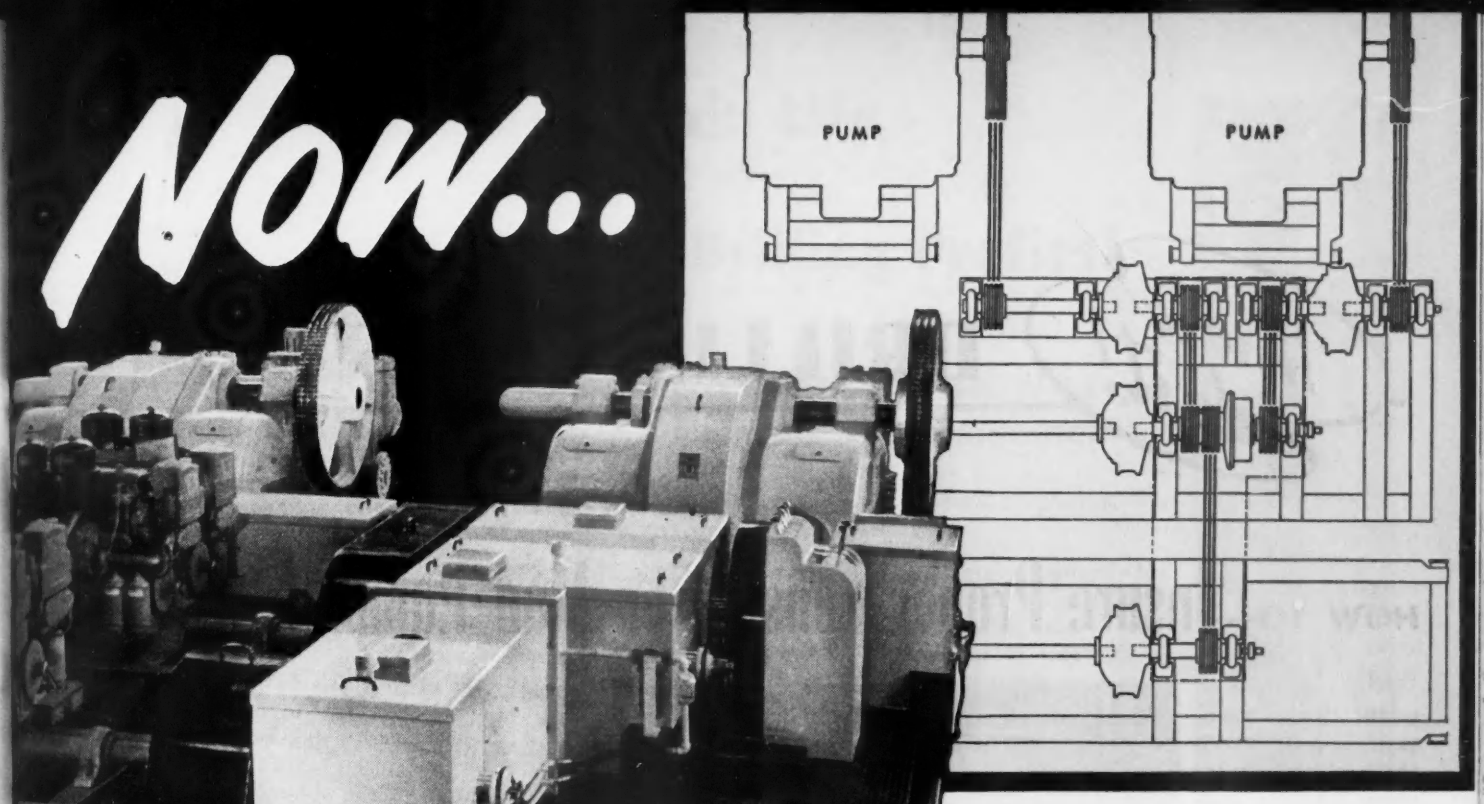
Sodium Carboxymethylcellulose

Sodium carboxymethylcellulose (Na-CMC) is added to a mud to control the filter loss and the control is effective in the presence of calcium sulfate contamination. The viscosity and gel strength increases caused by the contamination are controlled with thinners such as caustic soda and quebracho solutions. Use in other areas indicates that the best control of viscosity and gels is obtained where sufficient caustic soda and quebracho have been added to raise the pH to about 12. However, high pH is not considered necessary for preservation of the NaCMC. NaCMC muds may be made in the same manner as lime-quebracho pretreated starch muds and they behave and are controlled in the same way. Moderately low filter losses of from 6 to 10 cc. API are easily obtained with NaCMC. Filter losses in the extremely low range are usually easier to attain by adding pretreated starch along with the NaCMC.

Conclusion

Each of the treatments described is applicable to certain well conditions. The most important of these conditions, when considering the treatment to be used, are the amount of anhydrite or gypsum to be drilled and the maximum filter loss desired.

Now...



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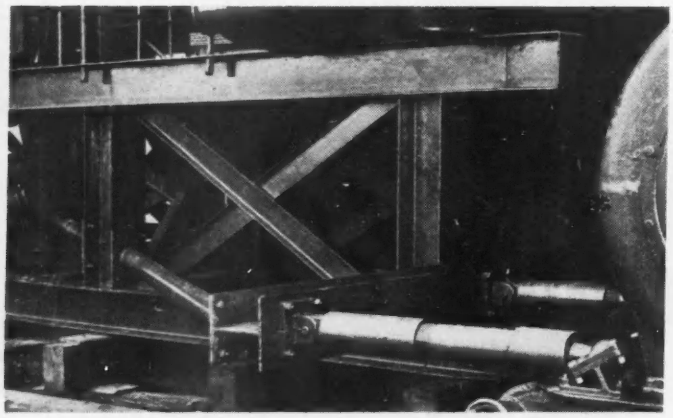
HOW TO—Insure Proper Tension on Mud Pump Drive Belts



It is important on power rigs to maintain adequate V-belt tension on mud pump drives to minimize belt wear. While idlers will accomplish this job for normal stretch, it is necessary that the mud pumps be adequately braced at the proper distance from the pump drive take-off on the power compound.

In the case illustrated, two large power mud pumps were placed side by side for ease in setting up and operating. Since the driving sheave on the pumps had to be placed on opposite sides, one pump had to be placed in a position which offset the engine substructure as shown.

Adequate bracing of the mud pump was provided so that proper belt tension could be insured by bolting a horizontal I-beam across the vertical members of the substructure. This beam extended out from the sub-structure far enough to mount the tension bars on the outboard side of the pump. It was only necessary to extend the beam across two vertical upright members of the sub-structure to obtain the required rigidity.

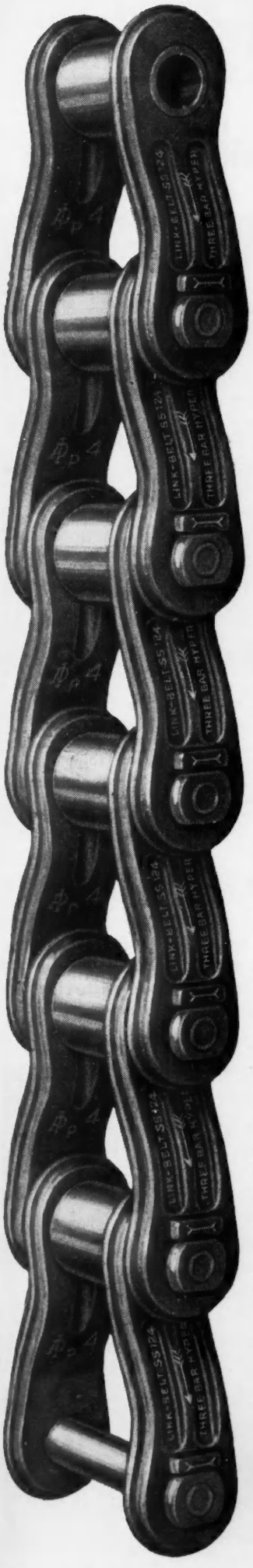
Back bracing of the horizontal beam was provided by three-inch angle braces which extend from the unsupported end of the beam back to the center upright beam on the sub-structure. This support was extended further into the substructure by a similar brace as shown at the extreme left. When the rig is moved, these braces can be disassembled by removing the bolts which hold them in place.

HOW TO—Protect Rubber Suction Hoses During Rig Moves

Rubber hoses on drilling rigs are always subject to excessive wear even under normal use, but these pieces of equipment receive unusually rough treatment when the rig is disassembled and transported to new locations. The mud pump suction hoses are subject to abnormal wear if the hoses are removed from the intake nipples since the steel pipe must be inserted into the hose again when setting the rig up.

The operation of removing the intake nipple from the mud pump suction hose was eliminated during rig moves by one operator who devised a clever method of protecting the hose during transportation by welding a sleeve of four-inch pipe to the suction nipple at each end of the hose. Each sleeve is equipped with a set screw attached by welding a nut on the sleeve which accepts the set screw.

Before moving the mud pump suctions, a length of three-inch pipe is run through the sleeves and the set screws are tightened. This method provides a rigid unit that can be handled with a winch without danger of kinking the suction hose, and also makes it possible to move the complete unit without breaking it down, thus saving much setting up and tearing down time.



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2 — PROPER ADJUSTMENT . . . run chains just a trifle more slack than a belt. Too much tension causes undue wear on chain and damaging friction on bearings. But a chain too slack will ride sprocket teeth and cause breakage, or even permit chain to jump off sprocket. Adjust properly and *save money!*

3 — PROPER LUBRICATION . . . use good, light mineral oil *only*. Faulty lubrication kills more chains than years of normal service. The presence of oil on outer chain surfaces does not necessarily mean that chain is properly lubricated. To be effective, the lubricant must penetrate between pins and bushings — constantly. To prevent corrosion, reduce friction and wear, lengthen chain and sprocket life . . . lubricate properly and *save money!*

4 — PROPER CLEANING . . . clean and lubricate chains *frequently* — remove chain occasionally for more thorough cleaning. Before replacing in service, *always* dip the chain in good, light lubricating oil — and *turn over slowly* until lubricant has penetrated all parts. Keep mud and dirt away from chains — prevent corrosion. A good rule: remove and *thoroughly clean* chains every time you move rig. Clean properly and *save money!*

5 — PROPER SPROCKETS . . . inspect sprocket teeth *regularly*. Worn teeth damage chain. Slightly worn teeth can be improved by grinding. But if teeth are broken or badly worn, sprocket should be replaced immediately. Another good rule: never install new chain on worn sprockets. Keep sprockets in proper condition and *save money!*

6 — PROPER CHAINS . . . *selection* of proper chains — as well as sprockets — is the final secret to Link-Belt's *"longer service with less maintenance"*. Drives must be suitable to power transmission required. Chain should be inspected regularly. If these 6 pointers are observed, you'll seldom replace Link-Belt chains. Use Link-Belt chains and sprockets — and *save money!*

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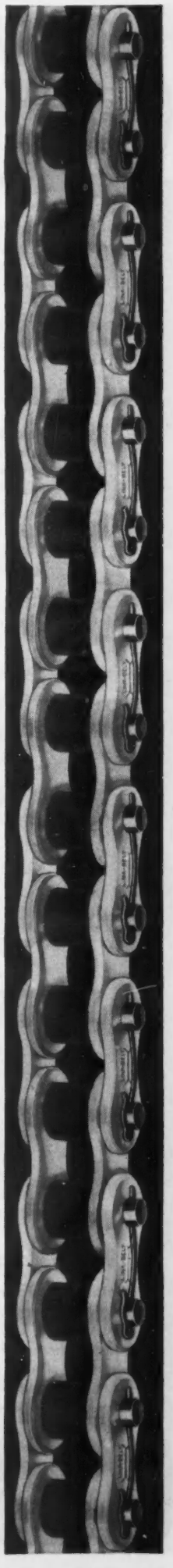

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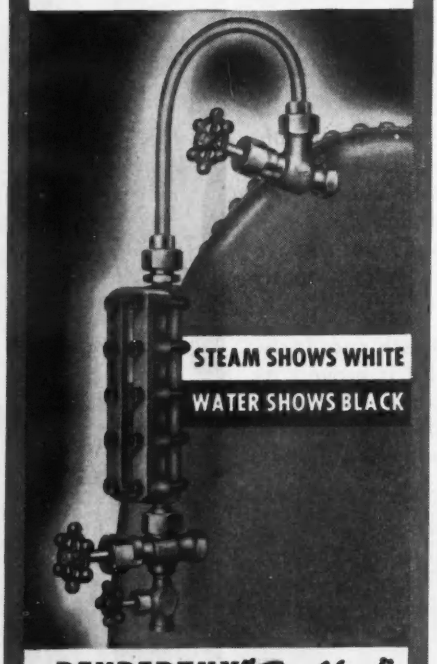

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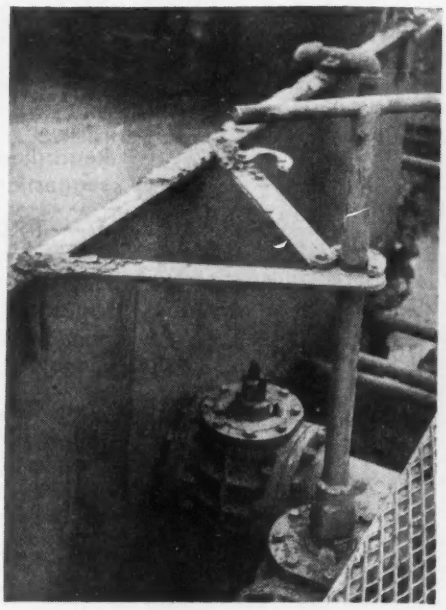
HOW TO—Support Sub-Floor Valve Extensions

Operation of large valves below the level of floors or walkways usually is facilitated by the use of extension handles which project through the floor to within easy reach of the operator. One company improves the operation still further by providing a triangular bracing device which holds such extension handles in an erect position and which at the same time assures proper positioning of the handle when it is set on the valve when the latter is out of sight beneath the floor.



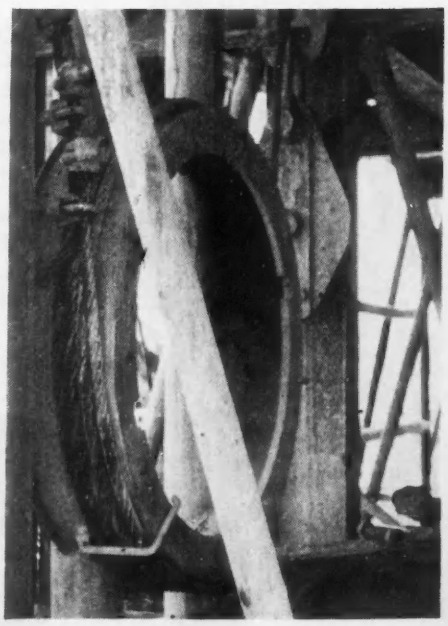
Two lengths of flat steel bar are bolted to the side of a tank or any structure that may be nearby. A latching device of semi-circular shape which is swung into place and locked with a pin, holds the stem in place at the apex of the triangle formed by the two arms and the tank side. If such an installation is carefully planned and laid out with respect to positions of other valves nearby, it is possible to include additional stem locks at other points on the same arms. Such an installation is easily built and installed at numerous points around the rig. When equipment is torn down and moved, the arms may be unbolted and removed, or folded back parallel to the side of the equipment to which they are attached.

HOW TO—Construct Derrick Dead Line Anchor

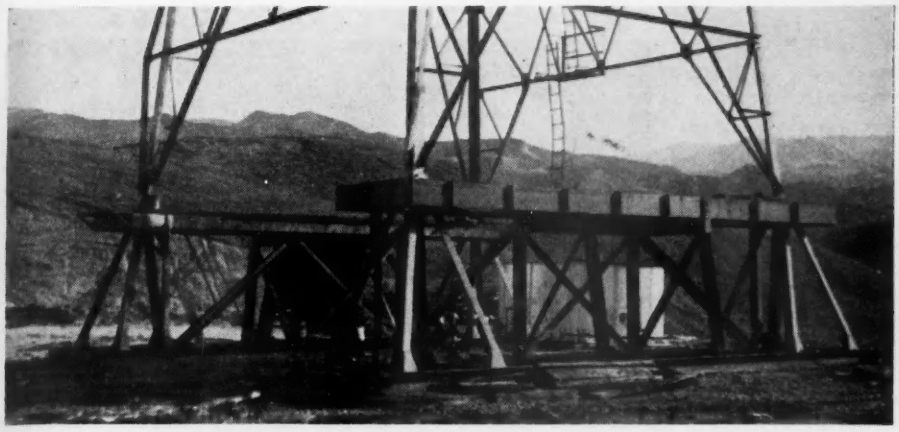
Damage to drilling lines by fastening the dead line around sharp corners has been eliminated by many types of dead line anchors. A satisfactory anchor was constructed by one operator who utilized a salvaged drawworks brake flange for the purpose. The flange was welded to the derrick substructure in such a position that the dead line would be in the desired corner of the derrick.

A retaining clamp made of seven-eighths-inch bar steel was welded to the flange to prevent the line from slipping off the guide and to facilitate the installation of the line. The free end of the dead line was clamped to a short length of discarded drilling line which was permanently clamped to the substructure in such a position that the line was tangent to the rim of the drum.

Most brake flanges provide an excellent anchor since the radius is sufficiently large to prevent sharp bends in the drilling line and strength of the steel is adequate. Caution should be used in the selection of a flange in order to obtain one that is not cast iron or one that is not worn to the extent that it would be weakened. During rig moves, the anchor remains on the substructure, requiring little time in anchoring the dead line at the next location.



HOW TO—Make Sectional Derrick Foundation



A combination substructure for the derrick which is easily used for skidding can be made to eliminate separate corner piers. This structure lends itself readily to mounting on wood mats, or it may easily be set up on a concrete apron. The base of the structure is in two identical but separate pieces, each section supporting one side of the derrick.

The ground portion of the section is made by using two pieces of structural steel, the ends of which are finished in the usual sled runner fashion and tied to each other with heavy piping substantial enough to withstand heavy pulls when skidding. The corner piers are fashioned as truncated pyramids by using heavy angle iron with gusset plates at the base of each pier for added strength. A top section, also of structural steel, is superimposed on the lower section with structural steel risers and studding, cross braced and tied together to form a single piece of equipment.

Derrick corner irons are attached immediately above the piers to brace the legs when building the derrick. With this type of derrick substructure, the equipment handling the tools can be drawn into the area between the derrick supports, or removed without disturbing the foundation.

HOW TO—Fabricate Drain Plug for Mud Tanks

In order to simplify the periodic draining and flushing of portable steel mud tanks, a contractor in the Rocky Mountain area employs a plug of large diameter which is easily removed by one man. At the side of the tank, near the bottom, a circular hole is cut out, and a short piece of pipe collar of the desired size, usually 12- to 14-inch, is welded in place.

A short length of the threaded end of a piece of casing of similar size, and having a circular plate welded over its open end, serves as the plug which screws tightly into the collar section. To facilitate screwing and unscrewing the plug, two short bars of sucker rod material are welded to the outside flat plate in the manner shown. The handles make it possible for one man to quickly remove or tighten the plug without assistance of wrenches or chain tongs.

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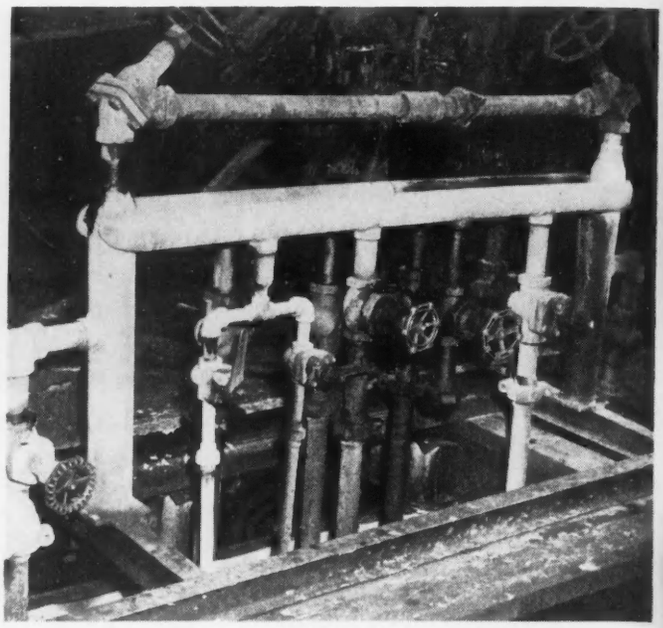
HOW TO—Skid Mount Water-Steam Manifold



The availability of steam on a drilling rig offers many advantages in performing a number of useful jobs around the location. Not only is it useful in cleaning grease and mud from the rig equipment, but steam pressure can be applied to transfer shale cuttings and drilling mud from one pit to another, as well as do many other things.

Utilizing both steam and water to a maximum in aiding efficient operations, the tool pusher of one steam rig designed a water-steam manifold that centralized the control of all work performed by both. The unusual manifold is illustrated and has been skid mounted to facilitate setting up and tearing down. The skid is made of four-inch light-weight I-beams as shown and has two upright sections of four-inch pipe welded to the skid at either end. The riser shown at left is for steam while that at right is for water. These two upright members are connected to two parallel three-inch lines. Each line is tied into the steam riser, while the nearest horizontal line is blanked off at the water riser at the far right. The horizontal line on the far side has been blanked off about midway to supply water only to the lines connecting into it.

Bridging across the top of both risers is a two-inch line on which has been mounted two angle needle valves at either end. This line furnishes a mixture of steam and water through a hose and is used in cleaning the rig floor and equipment. Other lines leading from the horizontal members carry steam for the floor heaters, the change house heaters, steam for the turbine used to drive the shale shaker, steam for jetting out the shale pit and for transferring mud from the reserve pit into the mud sump. On that portion of the horizontal member shown on the far side that is blanked off, water is supplied to the shale shaker, and to other parts of the rig requiring water. The arrangement is quite efficient, centralizing the control of all these functions and thereby eliminating searching for a valve.

HOW TO—Limit Travel of Reversing Lever

There are times when an over-anxious driller gives the steam engine throttle valve stem control rod a quick pull to reverse the steam engine. Because this sudden jerk is capable of breaking some of the smaller parts of the reversing mechanism, particularly with the leverage available, a limit stop must be added to prevent damage as well as to insure that only the movement necessary is made.

Of many variations in this type of control arrangement, the one illustrated offers interesting features. The reversing lever is limited in its travel by a one-fourth inch steel plate notched the

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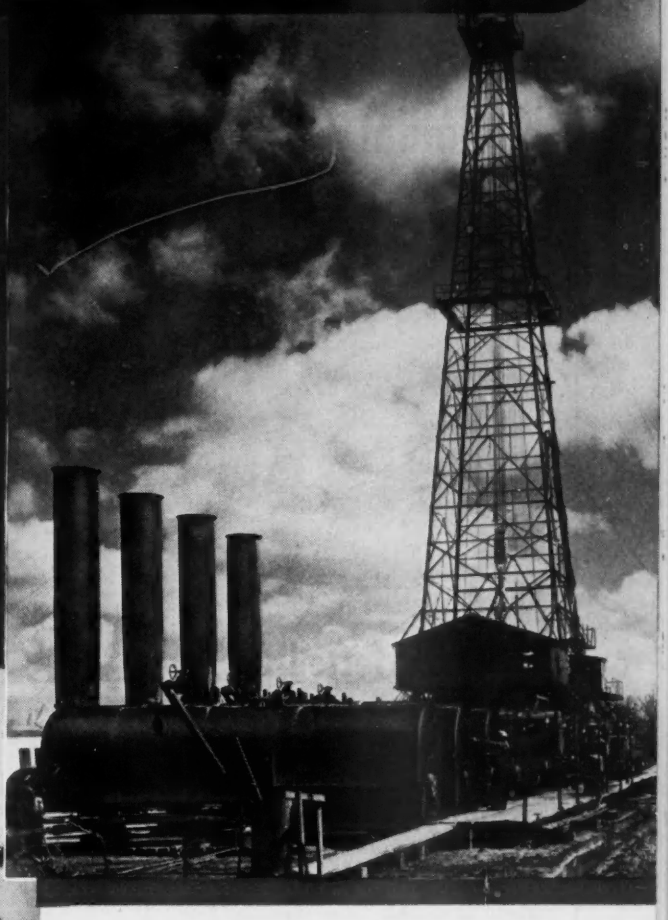

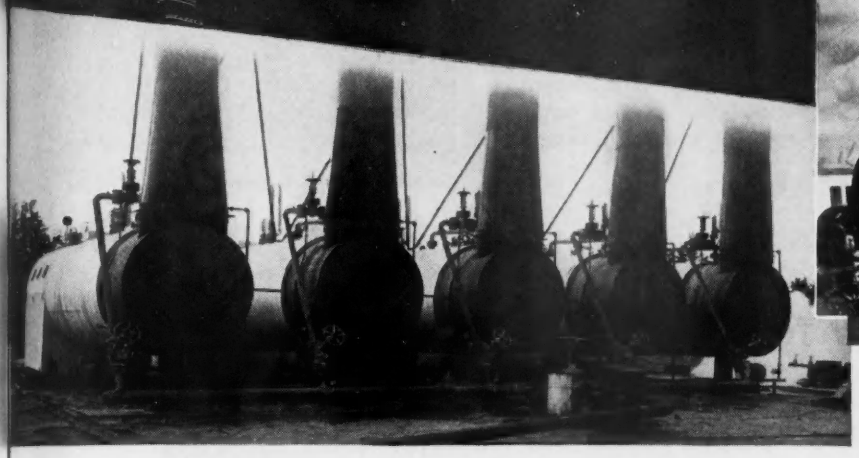

Left: Battery of five 150 H.P., 500 Lbs. working pressure boilers used on Superior Oil Company's record well in California.

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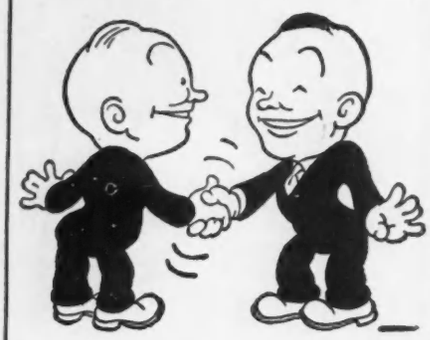

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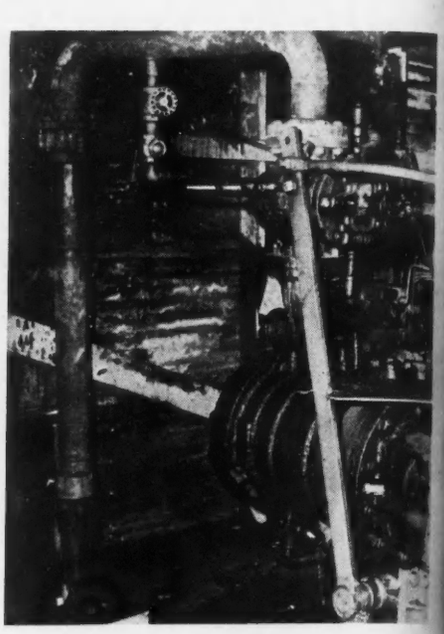
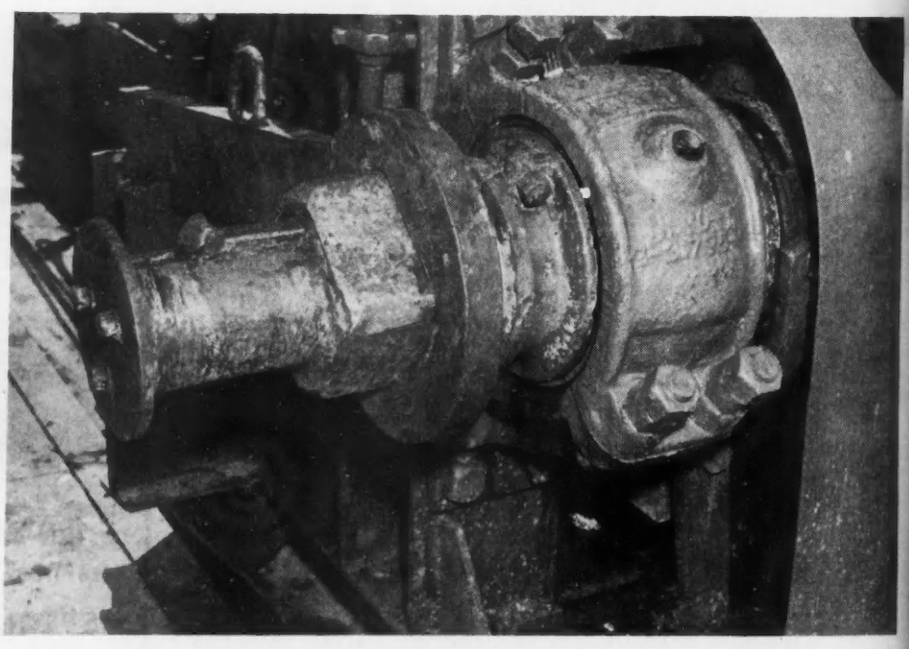
proper length. This plate is bolted to the top of the steam engine and is sufficiently strong to prevent the driller from pulling the lever beyond that travel necessary.

Of particular interest is the method of controlling the steam flow into the reversing cylinder. The quick-opening and closing valve is mounted on the steam line so that it is in line with the direction of pull on the reversing lever. This type valve is either full open or full close, and therefore, steam flow in the line is adjusted by a globe valve just above the quick-opening valve. Lever on the latter valve extends below the ell in the small steam line, and an adjustable linkage connects it with the reversing lever. A turnbuckle in this linkage permits just the right amount of travel so that no strain will be imposed on the valve due to a short linkage.



HOW TO—Lock Standby Drawworks Drumshaft



A method of positively locking the drum shaft of the standby drawworks unit when the latter serves as the deadline anchor is contained in the device illustrated. A square nut was slipped over and keyed to the exposed end of the drum shaft, and a wrench several feet long cut from a piece of two-inch steel plate was designed to slip over the nut. The tapered end of the wrench rests on a steel support located beside the drawworks several feet back of the shaft. The nuts in this installation is eight inches on each side and was bored to fit the 6½-inch shaft. A steel loop welded to the upper edge of the wrench facilitates lifting the heavy unit off the shaft whenever drilling line is pulled over or the drawworks is put into service.

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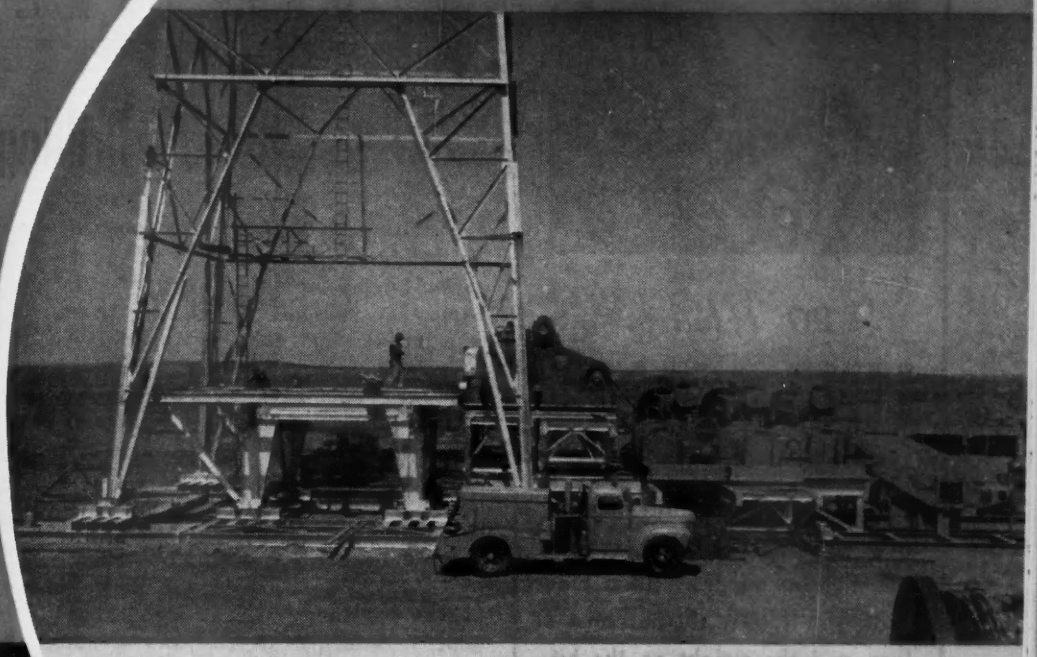
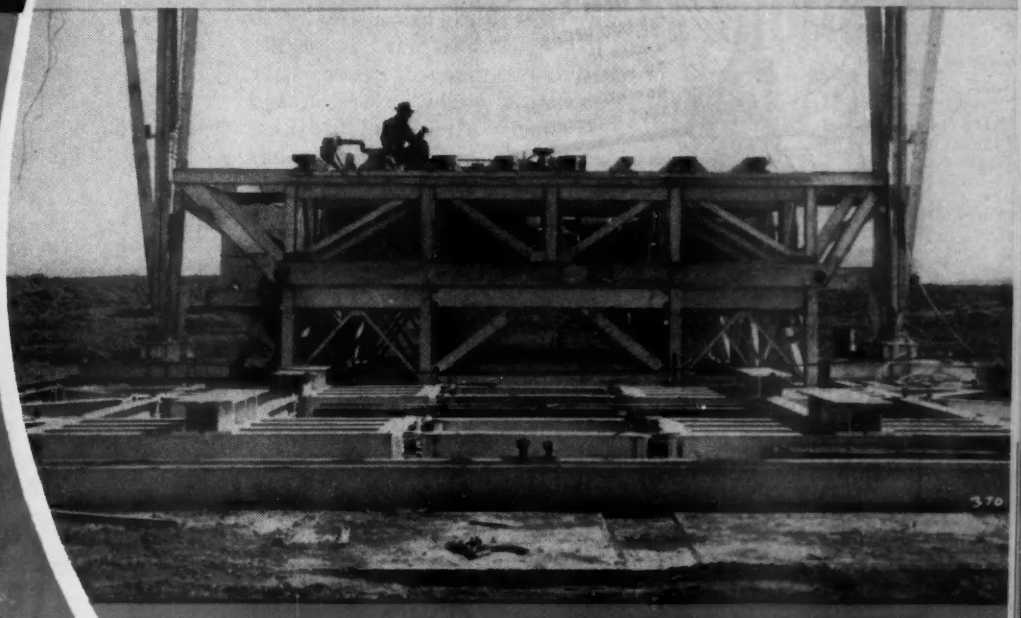


Above shows modern Lee C. Moore substructures for derrick floor, drawworks and power unit. The derrick substructure posts are positioned to take, most efficiently, the rotary and set back loads with minimum span of beam members, therefore maximum headroom is obtained for given floor height. Please note derrick substructure is independent of derrick and drawworks support is independent of derrick substructure.

Picture to right shows unitized pin connected grillage which accomplished proper distribution of loads on reinforced concrete mat. Picture taken before installation of derrick sub-structure. Also shown is well end of drawworks support. Note welded benches sized for transportation and provided with heavy pin connections for fast assembly.



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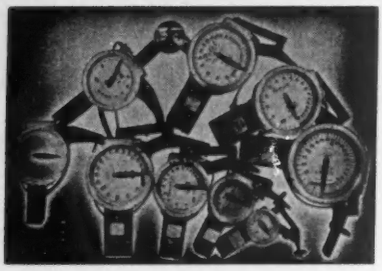

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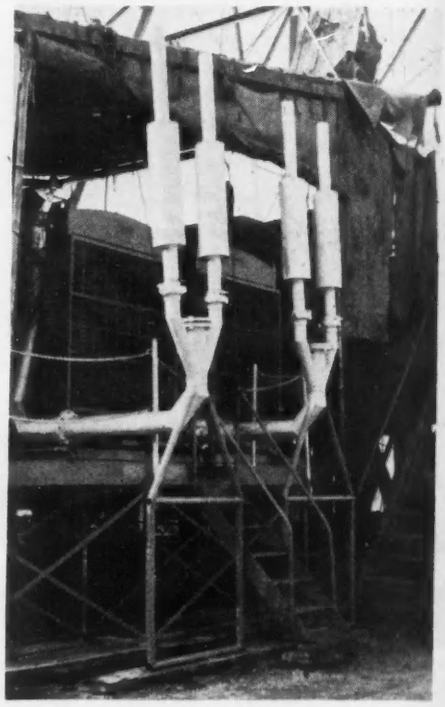
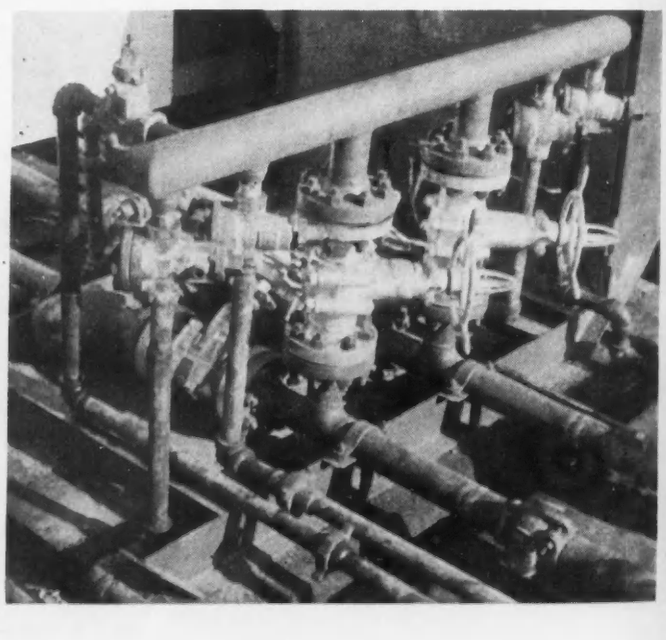
HOW TO—Unitize Drilling Engine Mufflers



Mufflers can be built and connected to drilling engines so they can be attached and detached easily, and at the same time, minimize weight on the engine fittings and exhaust manifold. To prepare such an installation, the exhaust pipe is designed to flange to the opening of the manifold and lead outward from the engine with a bolted flange near the end of the engine skid mounting. Mufflers are built in pairs so that if one develops a leak, it can be replaced without removing its twin.

A pipe with a companion flange to match the flange on the fixed exhaust pipe is attached to ells and a riser, which in turn is welded to an "A" frame support with legs sufficiently long to support the muffler and connections which are horizontal and with the exhaust pipe attached to the engine. Each muffler in the pair is attached to the riser with knock-off unions for quick removal and replacement. If the ground is uneven, timber cribbing can be used to raise the unitized muffler to the point where the bolted flange will be in alignment with the piping.

HOW TO—Manifold Mud Lines for Efficiency



A mud manifold can be constructed so that it is easily moved, reasonably light in weight, and fitted with lines, valves and take-offs so that all the necessary needs for pressure can be provided. The main hydraulic lines from the pumps are connected to a simply-made skid-type base, terminating on the down stream side in a manifold from which drilling fluid can be delivered to either of two standpipes as desired by making the required flange, or ground joint connections. Risers from each main line connect to a second manifold above the cutoff valves to which all lines are attached, and which are required for cementing, mixing mud and other functions required of mud circulation.

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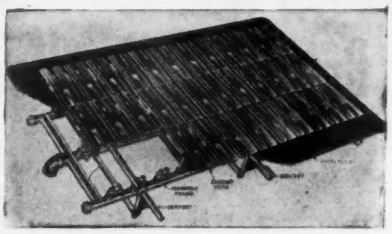

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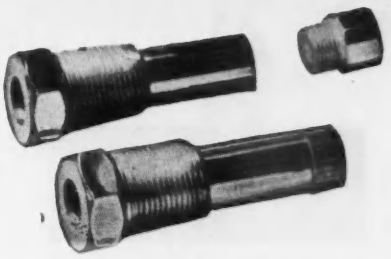

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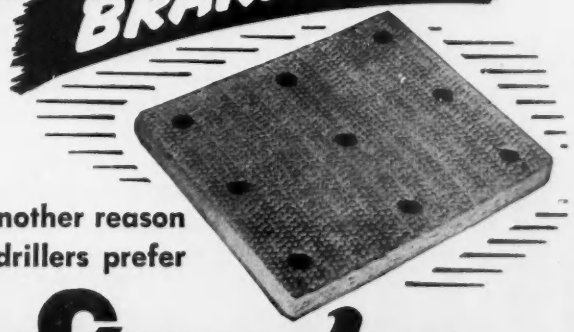

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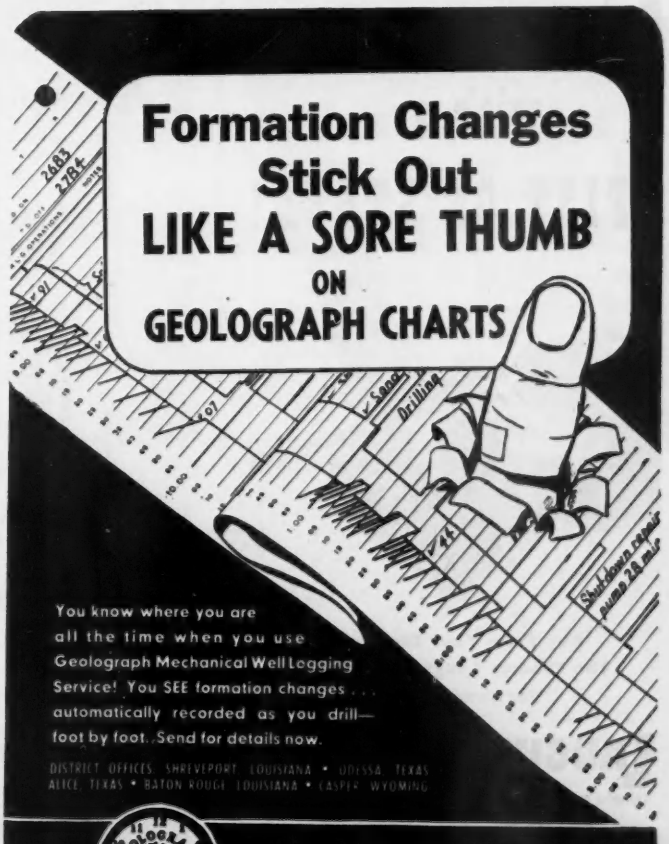

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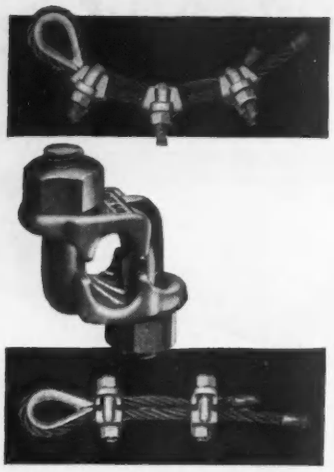

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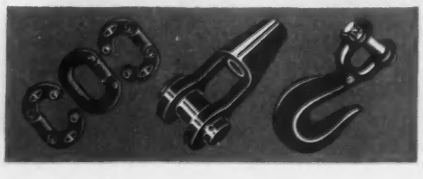
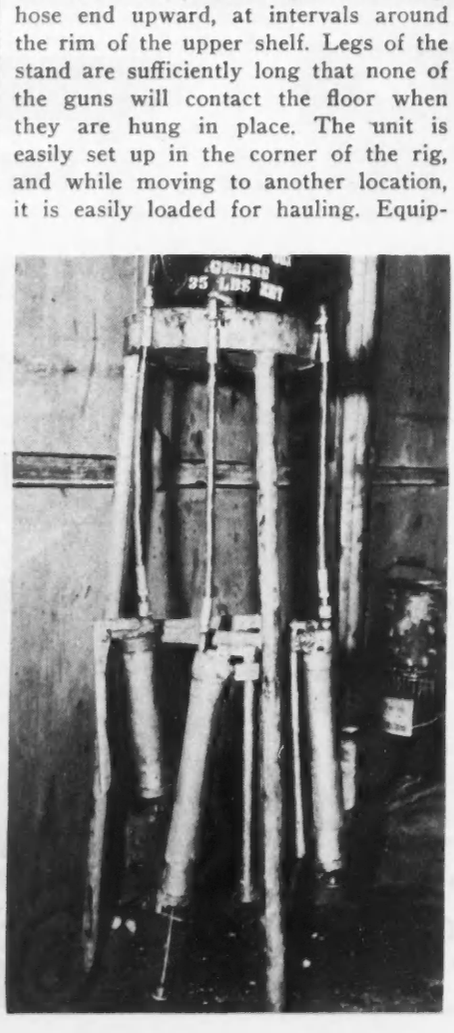


nections to simplify hooking up. A handy connection attached to the common header on the discharge of the hydraulic lines at the point where connections are made for the standpipe is one which permits bleeding down the standpipe and rotary hose before breaking down the stand. In this manner, the derrick floor can be kept clean.

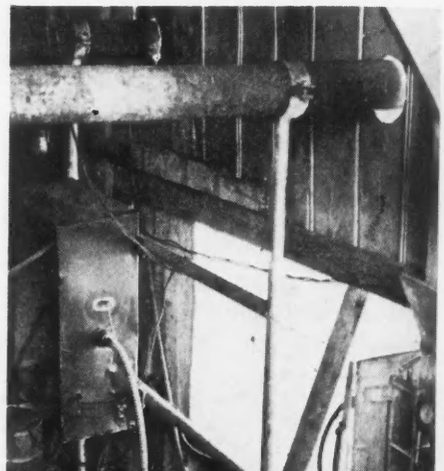
HOW TO—
Rack Grease Equipment

Proper storage of grease pails and guns on a drilling rig will increase efficiency in handling this equipment and improve the general appearance of the area in which such materials are stored. One drilling company devised a small three-legged stand which will accommodate two 35-pound pails of grease, and in addition, will support several grease guns in such a way that they are readily accessible to workmen.

The stand illustrated is all-welded and made up of salvaged pipe and steel plate materials. Grease pails are set on the two shelves, and the guns are hung, hose end upward, at intervals around the rim of the upper shelf. Legs of the stand are sufficiently long that none of the guns will contact the floor when they are hung in place. The unit is easily set up in the corner of the rig, and while moving to another location, it is easily loaded for hauling. Equipment stored in this manner will remain clean longer and will permit easier identification of the various greases and the guns containing them.



HOW TO—
Brace Exhaust Stacks



In certain Rocky Mountain areas where it is customary to partially or wholly enclose the engines and associated equipment during inclement weather, the problem of removing engine exhaust gases becomes extremely important. To support the ends of horizontally mounted exhaust stacks within such a housing, one company devised an adjustable stand, the two upright legs of which are adjustable to any desired height by movement of the upper telescoping sections.

The stand shown is made of pipe materials and is simple in construction, consisting of the lower horizontal member which rests on the floor or ground, and the two legs which are braced by two horizontal and two diagonal members. The uppermost part of each leg, that which telescopes inside the fixed lower portion, is secured at the desired height by tightening set screws located near the top of the fixed leg. Simple bolted clamps secure the exhaust stacks to the legs. No bracing at right angles to the axis of the existing support is required. The unit takes up little room within the enclosure and is easily transported and reinstalled.

Tubing Joints for High-Pressure Wells

By HAROLD S. KELLY and G. G. HEBARD
Phillips Petroleum Company, Bartlesville, Okla.

THE AUTHORS review the major design changes and improvements that have been made in oil well tubing joints since 1924, the year the API first inaugurated its work on standardization of oil field equipment. They also present the basic features of recently developed tubing joints designed to handle satisfactorily the severe conditions of pressure and corrosion that are encountered in the deep distillate wells of the Gulf Coast Area. The paper, substantially as appearing here, was read before the Mid-Continent District meeting of the API, Tulsa, March 23-25, 1949.

VARIOUS changes have been made at different times in the API specifications for oil well tubing to meet the gradual increase in tensile load and internal pressure that result from increased well depth. The very constructive committee work of the API was carried on jointly by oil production engineers and manufacturers' engineers. The tubing difficulties encountered and the corrective measures adopted for these difficulties are a matter of record in the Annual Proceedings of the API. Some of the most important changes are mentioned here because they are interesting and because they portray the history of the present API tubing joint.

Prior to 1926, some manufacturers furnished either 11½ or ten sharp "V" threads per inch on upset tubing, depending upon the preference of the purchaser. The first API specifications for oil well tubing were established in California in 1926. They included both regular and external upset, with 11½ sharp "V" threads per inch on a three quarter inch taper for the 1¼, 1½, 2, 2½, and 3-inch regular end; and ten sharp "V" threads per inch on the 1¼, 1½, 2, 2½, and 3-inch external upset end. The following year at Colorado Springs the 3½-inch regular and 3½-inch and 4-inch external upset tubing sizes were added to the standards with 11½ threads for the regular and ten threads for the upset. These additions were caused by the extensive use of gas-lift in the Mid-Continent fields, particularly in Seminole. The larger sizes were used in tapered or telescoped flow strings.

The 11½-tread plain end tubing was commonly used in the shallow wells, but as the well depth and sucker rod motion increased, difficulties were encountered with it. Failures occurred in the joint due to rod wear or insufficient tensile strength. The cross-sectional area at the base of the last effective thread on the male end of plain end tubing is approximately 70 percent of that for the body of the tube. For upset tubing, the cross-sectional area at the base of the last effective thread is 25 percent greater than the cross-sectional area of the tube body. Thus, for moderate depths, the API upset joint with the 60-degree sharp 10 "V" thread gave sufficient

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In 1935 he became associated with The Pure Oil Company and in 1942 resigned to become engineering construction coordinator and works engineer for Diamond Magnesium Company. In 1945 he returned to the oil industry as production engineer, heading the development section of the Production department of Phillips Petroleum Company, a position he now holds.

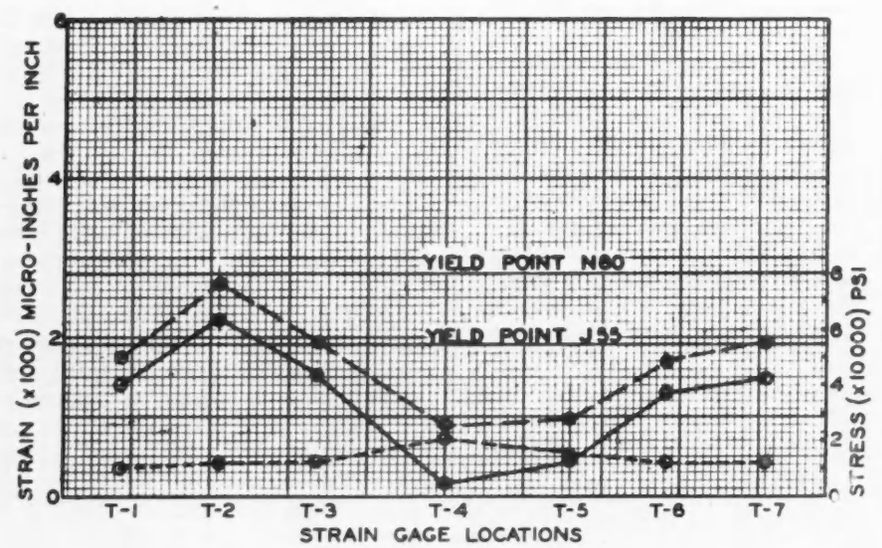
H. S. KELLY received his B.S. degree in petroleum engineering from the University of Oklahoma in 1931. After a year of field production experience in Southern California, he joined Phillips Petroleum Company. He is a member of Tau Beta Pi and Sigma Tau.

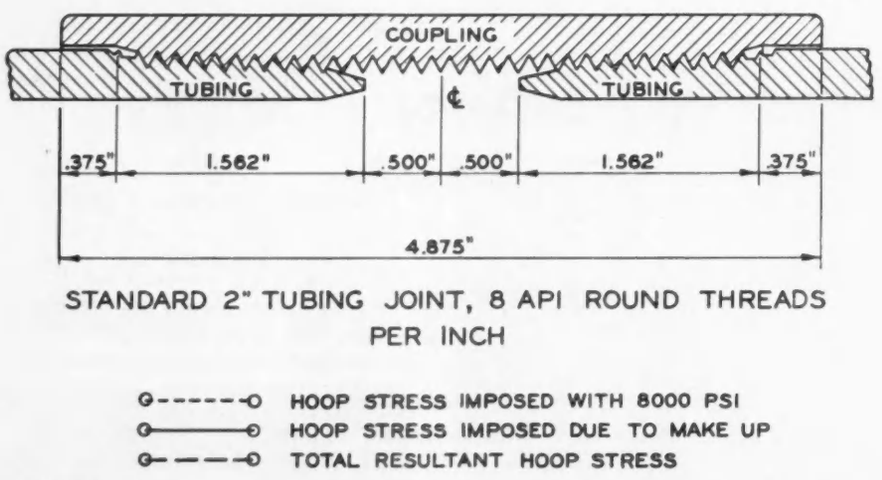
strength and it would stand more rod wear than the tube body.

The API specifications for the sharp 10 "V" thread (Briggs) stood for ten years. During the 1930's, joint troubles developed, primarily in the form of leaks, due to the higher internal pressure and tensile loads encountered at the greater well depths. It was reported that manufacturers were not meeting API specifications in some cases, particularly with respect to thread taper. A special API Subcommittee on tubing investigation was appointed in May, 1935, to investigate tubing failures, particularly as related to the design of the joint and to make a field survey of tubing failures and their causes. In the field survey, it was difficult to obtain records of strings from the time of initial installation to the time of removal and nothing conclusive was obtained from field records concerning joint design. It was determined, however, that tubing is an element of considerable maintenance expense. The cost per barrel is frequently higher than that chargeable to sucker rods. Operators in the Smackover and Tonkawa areas were experiencing excessive amounts of thread and collar failures with both regular and upset tubing.

In addition to the field data, a large number of samples were obtained of new tubing from oil company warehouse stocks. Samples of used tubing were also secured. These were inspected in a laboratory at Pittsburgh. No light was thrown upon inaccurate taper and thread form being a source of possible joint leakage although the data indicated that manufacturers were taking full advantage of the extreme limits of the API taper range.

The drill pipe round-thread form was then considered by the API Committee on the Standardization of Oil Country Tubular Goods. It sponsored tests on casing which were reported by P. A. Mills of Moody Engineering Company in 1938. These tests showed the 8-round thread form to be superior to the 10 sharp "V" thread from the standpoint of fluid seal but in tensile strength the latter was superior. The tests showed that on casing either type thread might leak if the taper on the male and female ends differed the maximum permitted by the API specifications. The manufacturers were able to hold to slightly closer tolerances with the round thread design and the hand tight make-up was more uniform. The round thread was less susceptible to damage and galling. It could be made up and broken out more quickly due to the fewer threads. Chiefly for these reasons, the 8-round thread (drill pipe) form was adopted by the API in 1938. The 10-round thread form was continued for 1¼ and 1½-inch upset tubing.





STANDARD 2" TUBING JOINT, 8 API ROUND THREADS PER INCH

HOOP STRESS IMPOSED WITH 8000 PSI
HOOP STRESS IMPOSED DUE TO MAKE UP
TOTAL RESULTANT HOOP STRESS

FIGURE 1. Hoop stress distribution in coupling with 2400 foot pounds make up torque.

Difficulties With Joint

Another ten years elapsed since the adoption of the 8-round thread. It has served satisfactorily under average well conditions even though the Mills laboratory study indicated that leakage might occur where the taper on the male and female ends differed the maximum permitted by the API specifications. In recent years some companies, particularly those operating in the Gulf Coast deep high pressure distillate pools, have experienced difficulties with thread leakage and corrosion in the coupling of the API 8-round thread tubing joint. They were unsuccessful in stopping the leakage with close adherence to API specifications, the use of various thread compounds, and extreme care in making up the joint. The API joint depends upon a spiral plug of lubricant and filler between the base and crest of the threads to resist leakage. In time, this plug may be displaced under high pressure and leakage occurs. These difficulties prompted a study of the API 8-round thread with the aid of strain gauges and a new fundamental approach was made to the design of a tubing joint to withstand severe conditions of pressure and corrosion.

Hoop-Stress in the Coupling

It is difficult to make up the API 8-round thread tapered joint tight enough so it will not leak and still avoid excessive hoop-stress in the coupling. It has been found through field experience with 2⅜-inch outside diameter, API upset, 8-round thread tubing in high pressure distillate wells, that a makeup torque of 2000 foot-pounds is necessary to secure a seal and even then some leaks occur. Strain gauge studies on this joint using the Baldwin-Southwark SR-4 wire resistance strain gauges also indicate that 2000 foot-pounds are about the minimum safe torque value to use for satisfactory sealing. With no metal-to-metal seals and no gasket seal, the API joint has only thread interference and thread lubricant to form a fluid seal. A slight difference in the taper of the male end

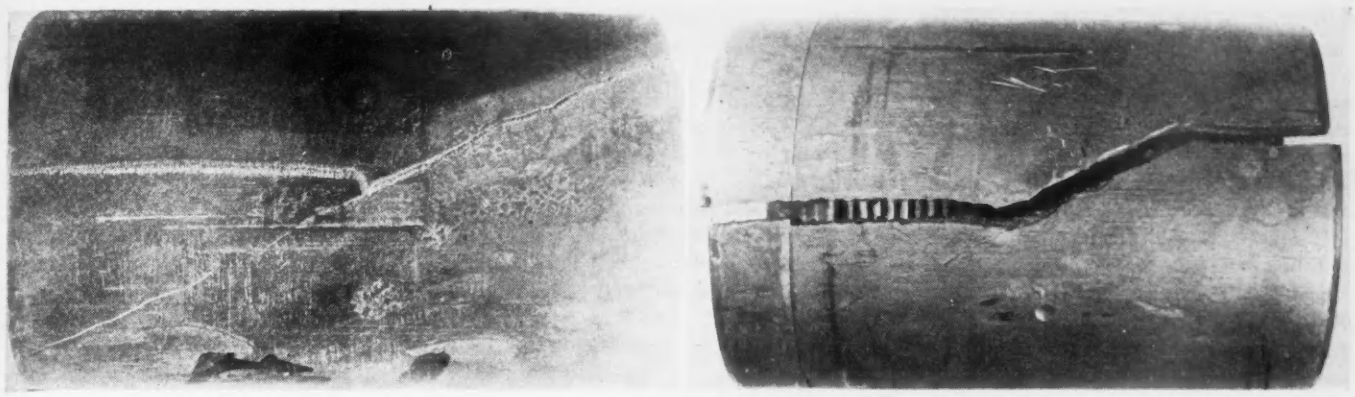


FIGURE 2. Left, two-inch N-80 coupling with seam. Right, two-inch N-80 coupling with seam failure.

and the coupling makes it necessary to impose enough makeup stress in the joint to where the male and the coupling are deformed slightly to get them to conform to each other and obtain a seal, and if either part is stressed beyond its yield point it remains permanently deformed. Further, these strain gauge tests show that if the makeup torque is above 2400 foot-pounds there is danger of yielding the coupling. Figure 1 depicts the hoop-strain and hoop-stress in a two-inch API 8-round thread tubing joint as measured by seven strategically placed strain gauges when the joint was made up with 2400 foot-pounds of torque. In this case the hoop-stress in the coupling due to makeup varied from 5000 to 65,000 pounds per square inch, and with the additional stresses imposed by internal pressure and tension loads, the yield point of 80,000 pounds per square inch for the N-80 steel can easily be exceeded. This high hoop-stress may cause splitting of an N-80 coupling when the tension load is added, since the N-80 steel is highly notch sensitive and critical notches may exist due to tong die marks or seams in the steel. Figure 2 depicts two typical two-inch N-80 coupling seams; one coupling with Magnaflux powder adjacent to the seam and one coupling that actually parted along the seam when high hoop-stress was imposed after running it in the well.

Since the API joint has no shoulders to control the amount of makeup and the coefficient of friction may vary widely, there is no means of postively ascertaining the amount of imposed hoop-stress due to makeup except through the use of SR-4 strain gauges. Strain gauge tests show that hand-tight makeup varies widely with different joints and is not a reliable base from which to start counting turns makeup to secure uniform makeup in the field. If the tubing is wrenched up with about 400 foot-pounds torque and stopped, a more reliable reference point is established from which to start counting turns makeup. From this point, each complete turn adds approximately 30,000 pounds per square inch hoop-stress to the stress in the coupling.

TABLE I

Summary of the Important Characteristics of the Various Special Tubing Joints as Compared to the API Joint

FEATURES	API	Figure 3	Figure 4	Figure 5	Figure 6
Type of Joint	Coupled	Coupled	Box & Pin	Box & Pin	Box & Pin
Joint O.D.	3 1/16 in.	3 1/16 in.	2 13/16 in.	3 in.	3 1/4 in.
Area Critical Sec. Female	2.44 sq. in.	2.47 sq. in.	2.38 sq. in.	2.51 sq. in.	3.22 sq. in.
Area Critical Sec. Male	1.62 sq. in.	1.62 sq. in.	2.04 sq. in.	2.05 sq. in.	2.51 sq. in.
Bore Characteristics.	1 in recess—thds. exposed	1 in. recess—thds. exposed	Slight recess	Smooth with flush shoulders	Slight recess
Outside Profile	Not streamlined	Not streamlined	Fully streamlined	1/2 Streamlined	1/2 streamlined
Shoulder Stop	None	None	One—outside	One—Inside	None
Make Up	Uncontrolled	Uncontrolled	Controlled	Controlled	Uncontrolled
Hoop Stress	Uncontrolled	Uncontrolled	None	Controlled	Uncontrolled
Threads	8 Round	6 Acme	Two step—6 Modified buttress	Two step—6 Modified buttress	5 Acme
Thread Interference	Flank	Flank	None	None	Crest & Root
Thread Taper	3/4 in. per foot	3/4 in. per foot	None	1/2 in. per foot	1 1/2 in. per foot
Metal to Metal Seats	None	One—outside land	One—Inside land	Three—Inside, center and outside lands	Two—Inside and outside lands
Pressure Sealed Flexible Gasket	None	None	None	One—center land	One—Inside land
Joint Leak Resistance Properties	Fair for pressures to 2,000 psi	Good for pressures to about 2,000 psi	Good—tested to 20,000 psi without leak	Good—tested to 20,000 psi without leak	Good—tested to 20,000 psi without leak
Joint Ruggedness	Fair	Fair	Fair	Good	Very Good
Dependability of Fluid Seal	Fair	Fair	Fair	Very good	Very good
Ability of Joint to Serve as Drill Pipe on Workovers	Fair	Fair	Fair	Good	Very good
Measures Taken to Prevent Galling	Couplings are zinc plated inside	Couplings are zinc plated on inside	None needed	Complex phosphate treatment	Copper plated

Longitudinal Seams

Magnaflux inspection of J-55 and N-80 tubing has revealed numerous short longitudinal seams in both the tubes and the couplings with a depth of more than the API allowable of 12½ percent of the thickness of the tube.

The following tabulation shows the composite results of Magnaflux inspection of a considerable amount of two inch N-80 tubing from four different manufacturers.

	Tubes	Couplings
A. Total number Magnafluxed	17,703	17,703
B. Found with seams		
—Number	4,045	1,206
—Percent of A	23	6.8
C. Number of seams checked for depth	3,924	1,071
D. Seams found to be deeper than 12½% of nominal wall (.024 in. depth)		
—Number	543	438
—Percent of C	14	41
—Percent of A	3.1	2.5

The seams occur more frequently in the N-80 steel. They have given little trouble in the usual oil wells, but under the severe conditions imposed by deep, high pressure distillate wells, they do become objectionable and a few failures have been experienced. The fact that 2.5 percent of the 17,703 couplings inspected had seams deeper than the API allowed depth of 0.024 inch is important when associated with high hoop-stress.

The number of seams of more than 12½ percent of the wall thickness varied in the tubing of the four manufacturers. It ranged from 1 to 3.6 percent in the tubes and from 0 to 3.9 percent in the couplings, which shows that the mill's manufacturing control or technique can affect the quality of the steel with respect to the number of seams.

Features of Ideal Joint

The present API 8-round thread tubing joint is a result of modification of

the earlier 10 sharp "V" thread joint. It was not specifically designed to handle the severe conditions that are now encountered in many deep wells. There are certain features that should be incorporated in the ideal tubing joint for these more severe conditions. Most of these features are not found in the present API joint. These desirable features are as follows:

EFFECTIVENESS OF SEAL: It is essential to be assured of a perfect seal at every joint with high pressures and high tensile loads when the tubing is handled with the usual field care. The field wear and minor damage that occur with use should not impair the effectiveness of the fluid seal.

JOINT TENSILE STRENGTH: the actual madeup tensile strength of the joint should be equal to the strength of the tube body even with thread wear and excessive makeup torque. A modified buttress thread is very effective in carrying the high tensile loads with a minimum tendency to swell the female end and permit "jumping out" of the male end.

RATE OF MAKEUP: A fewer number of coarse threads affords complete joint makeup with less turns and permits greater speed in installation. The use of step thread still further reduces the number of turns.

CONTROL OF THE AMOUNT OF MAKEUP: Due to the wide difference in the amount of makeup torque that the various field crews will apply, it is desirable to build the proper amount of interference into the joint and then limit this to the designed amount by using a shoulder-to-shoulder stop.

NUMBER OF THREADED CONNECTIONS: The elimination of the coupling and use of an integral joint reduces the number of threads by one half and thus halves the number of threads that could leak.

FREEDOM FROM GALLING: On most types of joints made of the presently used carbon or nickel steels, it is necessary to prevent galling by treatment of the points of metal-to-metal contact. The application of zinc, cadmium, or copper plating, or the use of complex phosphate coatings will accomplish this.

INTERNAL FLUSH JOINT: A minimum or no recess at the joint is desirable to avoid the turbulence and corrosion that occur due to the recess and exposed threads of the API joint. Tubing caliper surveys in some high pressure distillate fields reveal "ringworm" and localized corrosion within 15 inches of the ends of the joints. The "ringworm" corrosion was found, on the average, to be over twice as frequent on the bottom ends of the joints. In a typical example, of the top 78 joints of the string, 61 had localized corrosion within 15 inches of the ends. Of these 61 joints, 33 had corrosion at both ends, 23 at the bottom end only, and five at the top only. This tendency for corrosion to occur more frequently at a point just above the coupling has been interpreted by some as evidence that the turbulent effect created by the coupling recess contributes to the corrosion.

RUGGEDNESS: In well completions and workovers it is possible to save rig time and expense by temporarily using the production tubing for drill pipe. This calls for sufficient ruggedness in the joint to withstand the applied torque and compression loads.

COMPENSATION FOR WEAR: A shouldered joint needs some provision for taking care for wear and slight damage to the threads and metal-to-metal seals.

STREAMLINED EXTERIOR: A relatively small OD at the joint and streamlined shoulders are desirable to give maximum clearance in the well bore or casing and reduce the tendency of the string to become stuck at a tight spot in the hole.

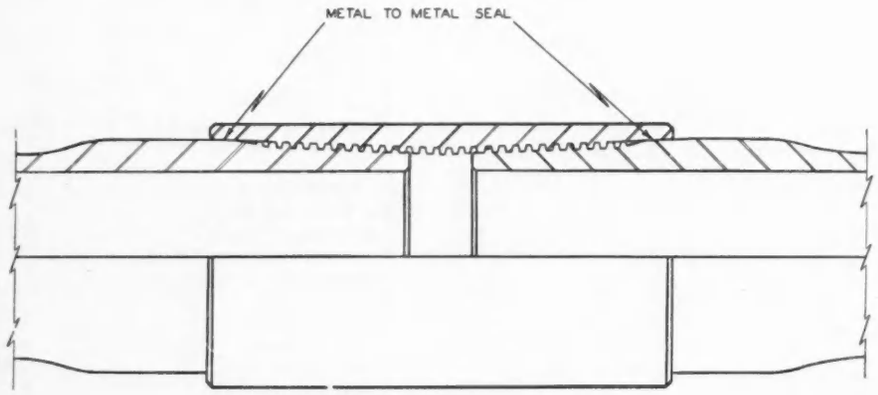


FIGURE 3. Coupling type. Acme thread tubing joint with six threads per inch on three-fourth-inch per foot taper.

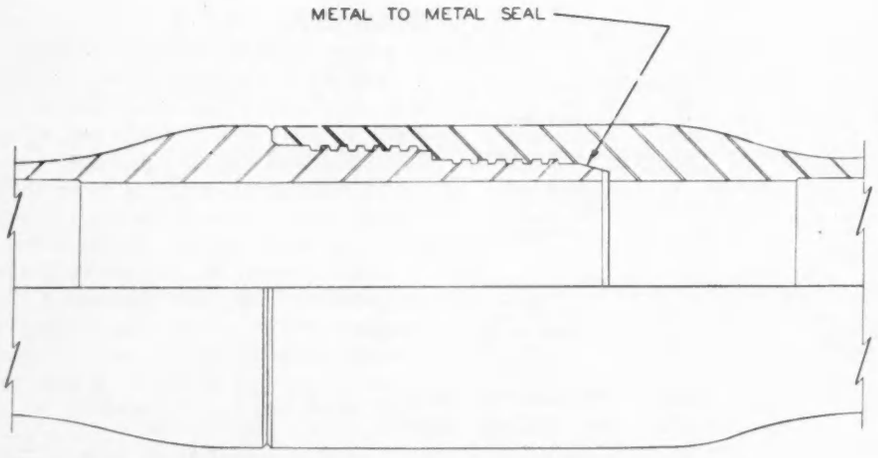
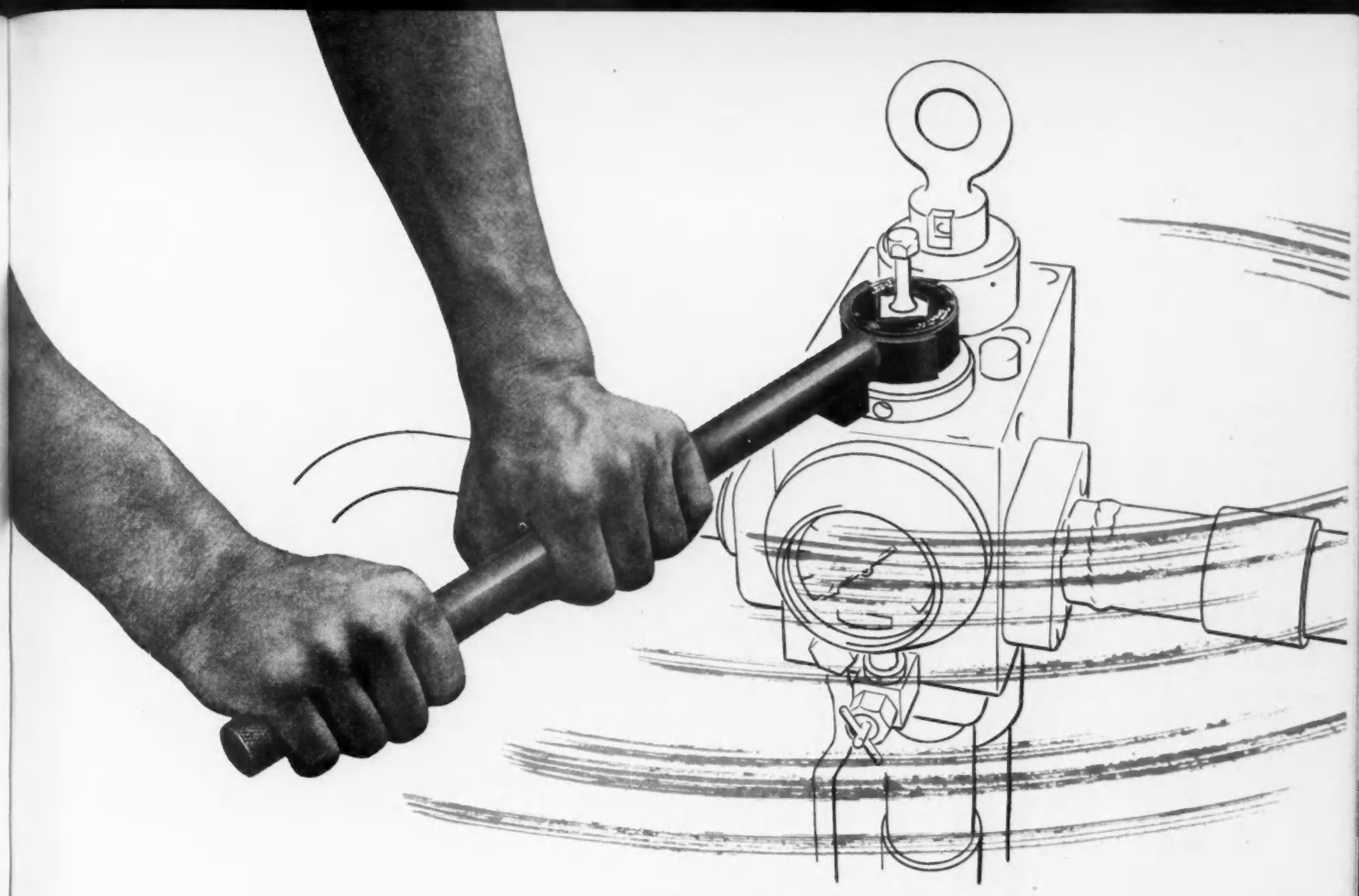


FIGURE 4. Box and pin tubing joint with 14-degree tapered metal-to-metal seal and two step 6 modified buttress threads per inch.

Justification for Heavy-Duty Tubing Joint

A special tubing joint incorporating all or most of the foregoing features would be a major improvement over the present API joint. It could be relied upon to meet satisfactorily all of the current needs for a heavy-duty joint. The frequency and seriousness of thread leaks and joint failures in each field will determine the economic justification for the special joint. If the Figure 5 joint is used instead of the API joint the average cost of the tubing will be increased by approximately 50 cents per foot. If the Figure 6 joint is used the increased cost will be approximately 75 cents per foot. With these premiums, the use of either of these heavy-duty joints can often be justified because the cost of moving in and killing a deep high pressure flowing well and replacing or repairing the tubing will average between $25,000 and $50,000 for each job. A single joint leak, in a 12,000-foot string containing 400 joints, can cause such an expense. One failure in 400 is only ¼ of 1 percent which statistically emphasizes



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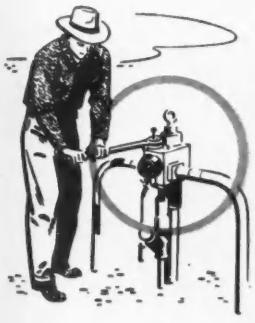

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the possibilities of a critical joint leak in a long string of tubing. The features of some of the presently available special tubing joints will now be reviewed. (For a brief summary see Table I).

Coupling Type Joint With 6 Acme Threads

The special joint depicted in Figure 3 has two intended improvements over the API joint: (1) The Acme thread with crest and root clearance is used to give tensile strength without the tendency to separate the mating surfaces which occurs with the 8-round thread. Greater speed is obtained in makeup with the fewer threads; (2) A metal-to-metal seal is used at the outside lands of the coupling. Laboratory tests and field experience have shown the outside seal in any joint is beneficial primarily in giving stiffness and alignment, and that with the limited amount of stock available in the end of the box of most joints, it cannot be relied on to maintain a fluid seal at pressures above 5000 pounds per square inch.

Joint With 14 Degree Tapered Seal

The special joint depicted in Figure 4 has been extensively used on special tubing for high pressure service. It has five important improvements over the API joint. (1) The box is an integral part of the tube. (2) A 14-degree metal-to-metal seal is used to give better sealing qualities, however, the only effective seal in the joint is at this point. Laboratory tests have proven this seal to be good for 20,000 pounds per square inch as long as the sealing surfaces are not damaged. (3) A two step modified buttress thread with no taper is used to give tensile strength, better stress distribution and rapid makeup. (4) An outside shoulder is used to control makeup and prevent damage to the 14-degree seal. (5) A streamlined interior and exterior is achieved with a maximum OD for the two-inch joint and only 2 15/16 inches which is one-eight-inch less than the OD of the two-inch API coupling.

Heavy-Duty Gasketed Joint

The special joint depicted in Figure 5 has performed satisfactorily on several 12,000 foot strings for high pressure distillate wells. It has seven important improvements over the API joint. (1) The box is an integral part of the tube. (2) Three metal-to-metal seals are used with a predetermined amount of interference built into them. (3) It has a resilient "O-ring" gasket which seals when pressure is applied. Either the combined metal-to-metal seals or the resilient seal will independently hold a low viscosity fluid at 20,000 pounds per square inch. (4) A two-step modified buttress thread on a one half-inch taper is used to give tensile strength, better stress distribution, and rapid makeup. (5) An inside shoulder is used to control makeup and hoop-stress and to give high torque capacity when used as drill pipe. (6) A smooth interior and a partially streamlined exterior are achieved with a maximum OD of three inches for the two-inch joint. (7) The critical cross-sectional areas are 58 percent greater than the tube body and the joint has been pulled to 200,000 pounds with no damage.

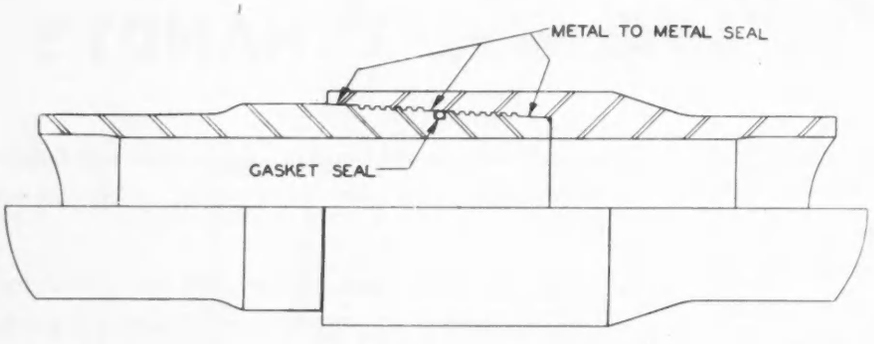

FIGURE 5. Heavy duty gasketed tubing joint with six modified buttress threads per inch on one-half inch taper per foot.

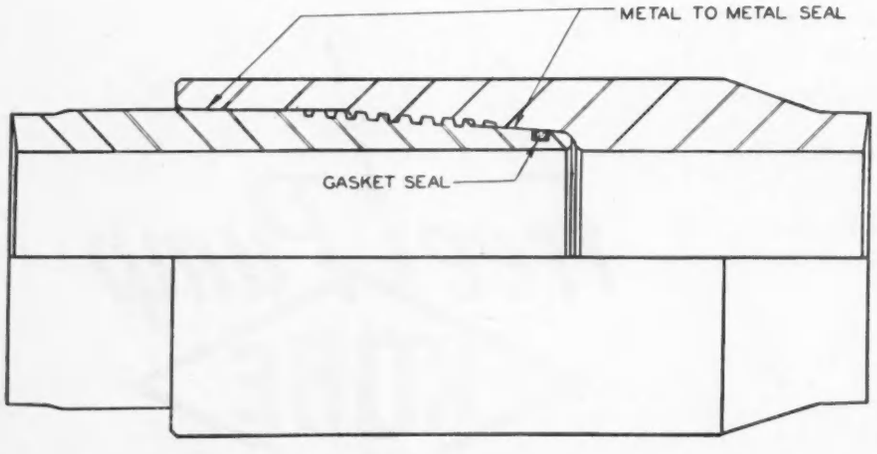

FIGURE 6. Flash welded—heavy duty gasketed tubing joint with five Acme threads per inch on 1½-inch taper per foot.

Flash Welded Heavy-Duty Gasketed Joint

The special joint depicted in Figure 6 may be flash-welded on either new or old tubing. It is essentially a tool joint made of high physical heat-treated steel with a resilient "O-ring" seal added and it has performed satisfactorily in field service. It has seven important improvements over the API joint. (1) The box is an integral part of the tube. (2) Two metal-to-metal seals are used. (3) A resilient pressure sealing "O-ring" is used. (4) Five Acme threads per inch with crest and root interference are cut on a 1½-inch taper. (5) The coupling is heavy enough to halt the male end at the proper point without the benefit of a shoulder-to-shoulder stop. (6) A relatively smooth interior and a partially streamlined exterior are achieved with a maximum OD of 3¼ inches for the 2-inch joint. (7) The critical cross-sectional area is 92 percent greater than the tube body. The joint has been pulled to 200,000 pounds without damage and both the metal-to-metal seals and the resilient seal have been independently tested with a low viscosity fluid to 20,000 pounds per square inch without leakage.

Conclusions

In view of the inadequacy of the present API 8-round thread joint, and in consideration of the physical conditions imposed upon tubing in deep high-pressure distillate wells, the practical limits of quality in the steel, and the extremely high costs associated with the pulling of a string of defective tubing, the conclusion is reached that the use of a special tubing joint is often justifiable even though it doubles or trebles the cost of the tubing.

The design, development and actual field experience with special tubing joints have progressed to where one of the presently manufactured special heavy-duty joints can be employed in any well with the assurance that it will satisfactorily seal and handle the most severe pressure and tensile loads.

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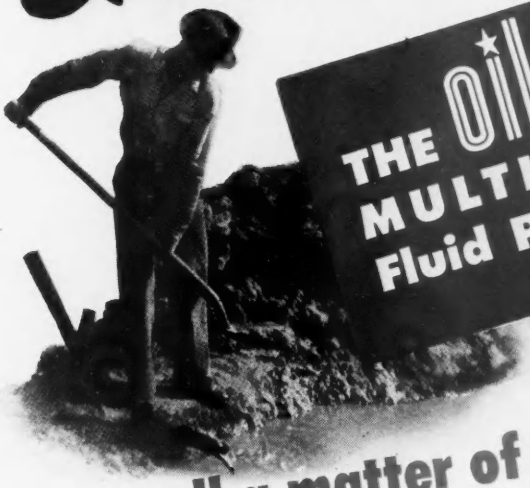

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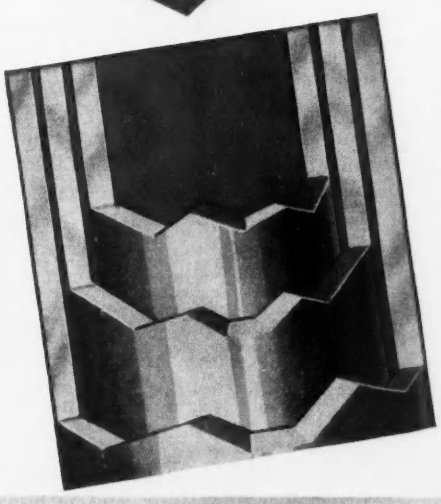
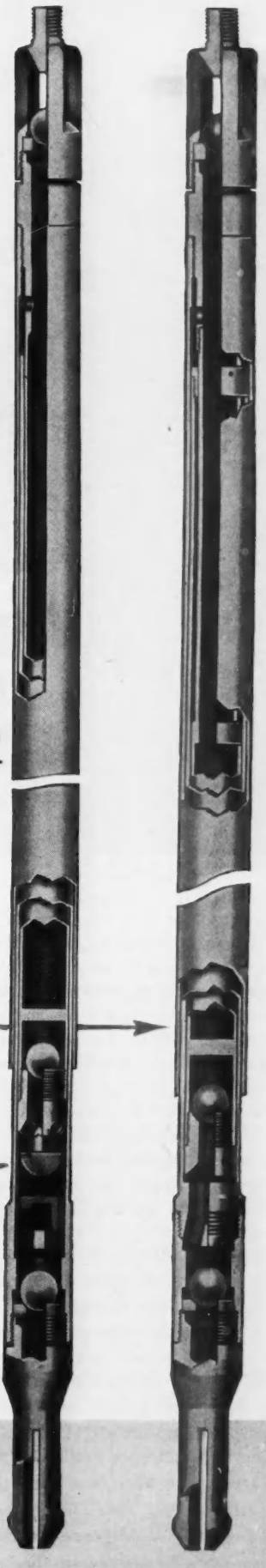


The POSITIVE PULL TYPE is recommended for general pumping conditions wherever the insert feature is desired. The entire assembly is installed and removed on the rod string.

The REMOVABLE TYPE is equipped with a manually operated hook-on device which makes removal of the standing tube and standing valve optional when the traveling tubes are pulled.

Illustration at left shows fluid packing in color. It is actually the fluid being pumped.



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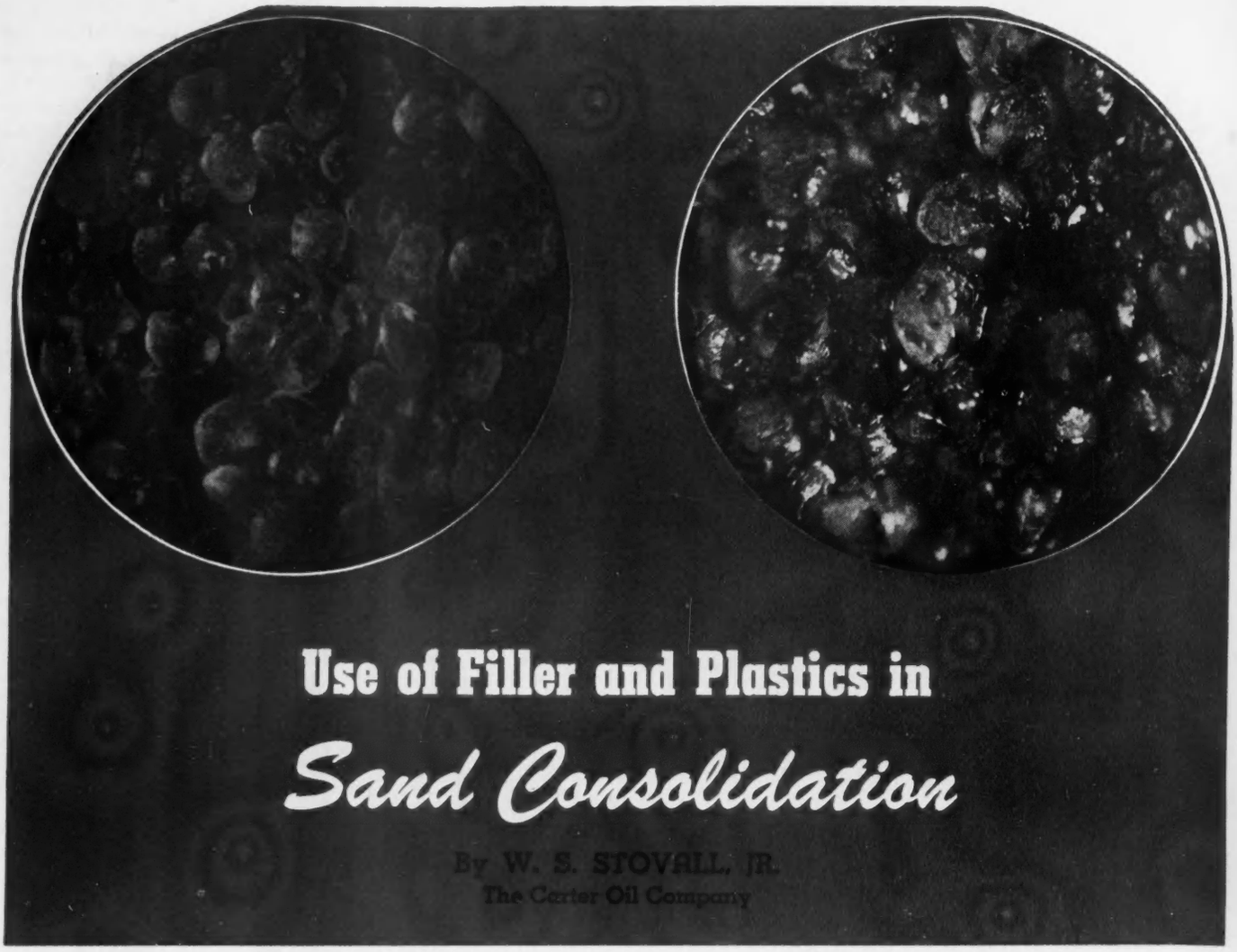


Use of Filler and Plastics in *Sand Consolidation*

By W. S. STOVALL, JR.
The Carter Oil Company

PRODUCTION PROBLEMS in a field with unconsolidated sands in the producing zone were greatly reduced in all wells and solved in others by use of special plastics to fill the sand near the perforations and consolidate grains for a distance into the formation so as to oppose a barrier against sand migration. The author describes the operation on a typical well and appends cost data.

THE completion of Miocene sand wells in the Choctaw pool, Iberville Parish, Louisiana, has presented a difficult production problem. Sands encountered in this formation are unconsolidated, varying in size from very fine grained and silty to medium coarse, and are productive at depths ranging from 2000 to 6000 feet. Because of their unconsolidated nature these sands break down under pressure and are produced with the oil, cutting out surface chokes or sub-surface pumping equipment, causing producers to "sand up," and requiring cleanouts and workovers, as well as repairs or replacement of surface or sub-surface equipment.

Past experience indicated that conventional wire-wrapped screens or pre-packed gravel liners had not proved practical in this field. Consequently, it was decided to experiment with the use of filler and sand-consolidating plastics in an attempt to overcome these production difficulties. This technique was applied to eight Miocene sand wells. Plastics were first used in the completion of Wilbert's Myrtle Grove 20, the first producer completed in the field after the resumption of shallow drilling, and was subsequently applied in other shallow producers.

Above microphotos are of unconsolidated sand grains before (left) and after the use of consolidating plastic. (Photos Courtesy Dowell Incorporated.)

Initial Well Completions

The Carter Oil Company as operator, and Gulf Refining Company completed the first wells in the Miocene formation in the Choctaw pool with slotted liners set through the producing zone. When it became evident that these liners could not exclude sand from the bore hole, wire-wrapped screens or pre-packed sand or gravel liners were installed inside the slotted or perforated casing. In some cases these screens worked well for short periods, but, as the wells began to produce water the screens, or liners, became corroded or were cut out and the wells started making large quantities of sand. Considerable expense was involved in cleaning out the wells, pulling the old liners or screens, and running new ones; troublesome fishing jobs resulted when the screens sanded up and had to be cut before being pulled. On pumping wells the majority of well servicing jobs resulted from the large quantities of sand produced with the oil.

Failure to overcome sand troubles by conventional methods prompted the experiments with filler and plastics in an attempt to secure sand-free completions. The Wilberts 20, selected for the initial experiment, was drilled to a total depth of 4014 feet, with seven-inch pipe set at 2972 feet. The top five feet of the zone to be produced was gun-perforated with four shots per foot and the perforations squeezed with 150 gallons of

sand-consolidating plastic. After the plastic had set and on a drill-stem test the well produced at the rate of three barrels per hour for 15½ hours and then sanded up. A second squeeze job in the same perforations using 50 gallons of consolidating plastic in each of two stages likewise was unsuccessful, the well sanding up on a drill-stem test after flowing 4.4 barrels per hour. It appeared that the sand body being squeezed and/or the cement around the casing contained crevices, or channels, that were thiefing the plastic and preventing the desired sand consolidation around the perforations. Consequently, the well was squeezed through the same perforations using 150 gallons of filler plastic and the zone reperforated and squeezed with 150 gallons of consolidating plastic. After being washed with oil the well flowed at the rate of five barrels of clean oil per hour through 10/64-inch choke under 255 pounds tubing and 200 pounds casing pressure, showing 0.1 percent sand. After flowing for approximately three weeks the production showed no trace of sand and the well flowed its allowable of 90 barrels of oil daily. A sand trap was installed and after producing for several weeks the trap began to collect a small amount of fine sand, and shake-outs showed 0.1 percent to 0.2 percent sand. Over a brief period the well produced this amount of sand which plugged up the choke about once a week, after which it produced clean oil over a comparable period. Later, the well started to produce salt water in measurable quantities but the sand failed to increase, although the well is currently producing a small percentage of sand.

Subsequent Results

Seven other wells were subsequently treated with plastics and of this number all but two are producing varying amounts of sand. One well was completed flowing sand-free oil and flowed for approximately seven months before sand showed up. Later this well started to produce water and the first sand was noted shortly thereafter. Slugs of sand were produced every two or three weeks, plugging the production choke and until sufficient sand was produced at one time to bridge the tubing and choke off production. After the bridge was cleaned out the well produced sand-free fluid for about three weeks and then slugs of sand entered the well periodically.

Difficulties were experienced on another well completion. After squeezing with the plastics it was necessary to pump oil into the formation and to use mud acid so as to regain the initial production capacity of from two to three barrels of oil per hour. A pumping unit was installed and the well pumped 97 barrels of oil in 24 hours with two percent sand. Since completion the well continues to produce some sand and has had to be bailed twice.

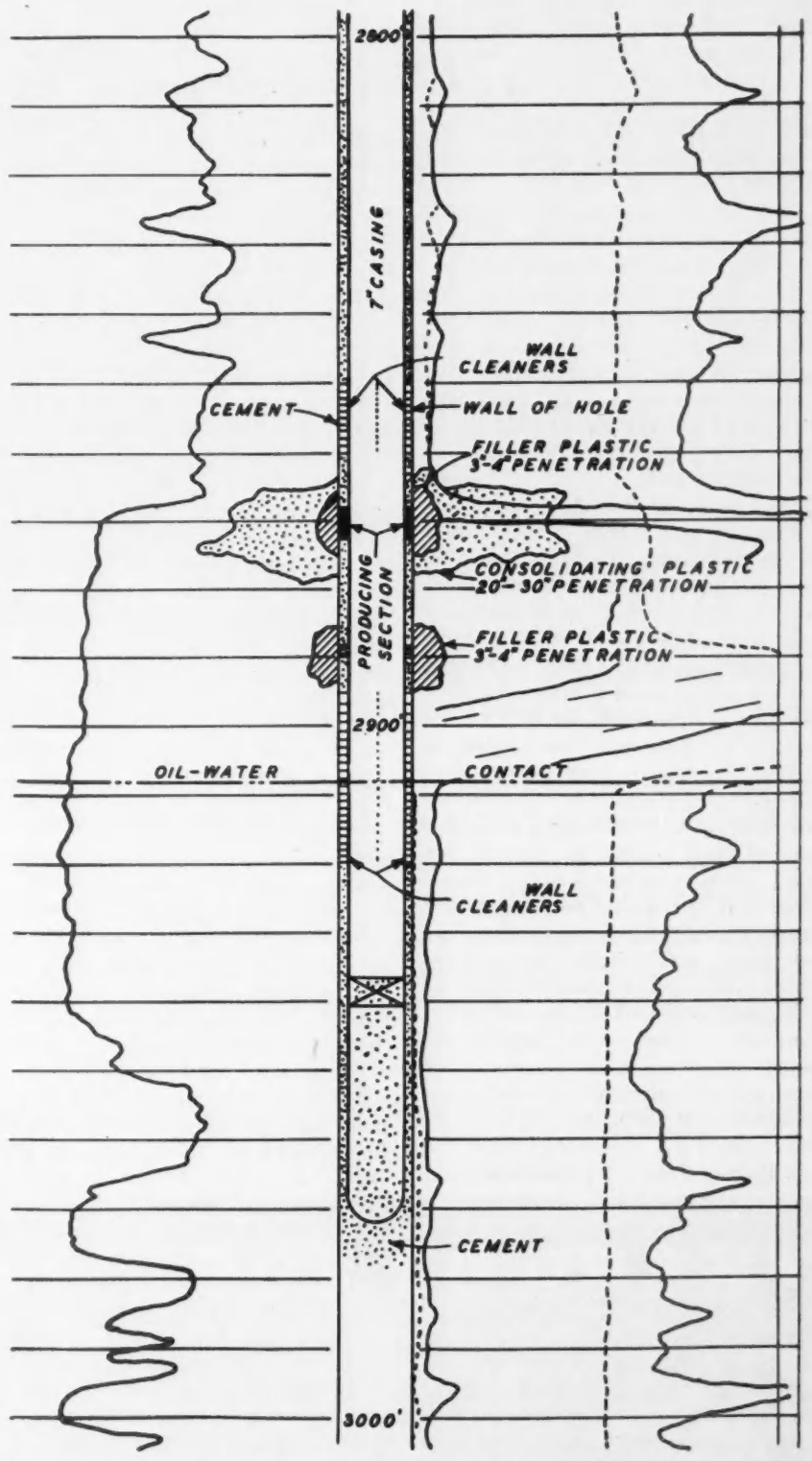
Two additional wells have produced a small amount of sand since completion, at intervals showing up to 4 percent.

A fifth well is producing between 0.1 to 0.3 percent sand. The well was brought in producing oil with no water but shortly afterwards started producing substantial volumes of salt water.

Of the two wells that have produced sand-free oil since completion one has flowed its allowable with no sand since February, 1947, and the other, completed in May, 1947, flowed 81 barrels of clean oil per day but declined rapidly.

Application Procedure

After treating the initial well the following procedure was devised in the application of the plastic to the other seven Miocene sand wells at Choctaw. The producing string was set using wall



Diagrammatic illustration of the use of plastics in completion of Wilbert's Myrtle Grove 20, Choctaw pool, Louisiana.

scrapers and cemented with a 2½ percent gel cement. The producing sand section was perforated with four shots per foot with a maximum of ten feet open. The perforated section was then squeezed with the filler plastic, drilled out, re-perforated and then squeezed with the sand-consolidating plastic. Sufficient plastic of each kind was used in each squeeze job to obtain penetration of the sand of from three to four inches with the filler and 20 to 30 inches with the consolidating plastic. The consolidating plastic was either drilled out or flushed through the perforations with crude, after which the well was washed and turned into tanks.

As already indicated, two types of plastic were used: (1) filler plastic to fill any cracks and crevices in the formation or channels which might have been left between the pipe and the walls of the hole after cementing and which might thief the consolidating plastic; and (2) the sand-consolidating plastic to coat the individual sand grains and form a retaining bond between them without plugging the sand pores. According to laboratory tests a one- to three-stage squeeze job is required for the filler plastic or until a pressure differential of from 1000 to 2000 pounds per square inch is established, this differential giving three to four inches of penetration into the formation. The filler may be placed through perforations in the actual zone to be produced or immediately above and below the producing zone. The producing zone is then perforated or, if necessary, re-perforated, and then squeezed with the consolidating plastic which is so fluid that no buildup in injection pressure is noted. The flow of the consolidating plastic is more or less controlled by the position of the filler plastic and is forced to spread out behind the perforations forming a continuous area of plastic-consolidated sand around the perforations. After filling the sand pores and setting, the plastic shrinks to between 25 and 75 percent of its original volume. Thus the individual grains are coated with plastic and bonded together in a honeycombed effect without affecting porosity and permeability of the sand.

Cost of Plastic Completions

The cost of a plastic squeeze job is considerably more than for the installation of a screen. The plastic, either filler or sand consolidating, costs $350 for the first 20 gallons, with an additional cost of $5 per gallon for the next 80 gallons and $4 per gallon for all over 100 gallons. For stage jobs an additional charge of $150 is made. Thus a one-stage squeeze job into the producing section using 200 gallons of filler plastic will cost approximately $1150 for the plastic and the use of the pump truck. For a five- to ten-foot sand section (seven-inch casing) approximately 200 gallons of the sand consolidating plastic is necessary for the 20 to 30 inches of penetration. This costs an additional $1150. The total cost of the plastic injection is approximately $2300 as compared to an estimated $750 for a wire-wrapped screen or $2000 for a prepacked gravel liner, none of which costs includes rig time. This difference in initial cost is reasonable, however, when compared to the cost of a work-over job to replace a "cut-out" screen or liner, which job may be necessary two or three times before the depletion of the well. The difference in pumping equipment repair costs between a sand-free well and a well that continuously produces large amounts of sand is difficult to estimate but will amount to thousands of dollars during the life of the well.

Data to determine why some of the wells produce sand-free oil, some produce only a small percentage of sand, and others produce considerable amounts of sand have been analyzed and the following reasons advanced:

1. Some filler plastic has been produced. In bailing a well in January, 1948, some pellets of filler plastic were recovered that appeared to have "popped-out" of the bullet holes in the casing. Evidently the filler plastic at those particular points failed of sufficient penetration into the sand to withstand the drawdown pressure across the sand face. This could have been caused by drilling mud reducing the plastic penetration, or by more permeable zones or channels thiefing the filler as fast as it was injected. With the casing perforated, the consolidating plastic probably was not squeezed out around the casing in a solid bond. It is more probable that the penetration was spotty leaving areas of unconsolidated sand. Then after the well produced for a short time, some of the filler apparently broke down opposite the initial perforations leaving them open for the production of some unconsolidated sand.

2. All sand produced appears to be sand that has never been consolidated. In line with the data presented in the above paragraph, this is the difficulty that would be expected.

3. The well being produced by sucker rod pump produces more sand than any of the other wells. The drawdown across the sand face in this pumping well is probably greater than that in the flowing wells. Consequently, any sand would break down to a greater degree in this well than in the flowing wells. The greater amount of sand produced from the well is, therefore, expected.

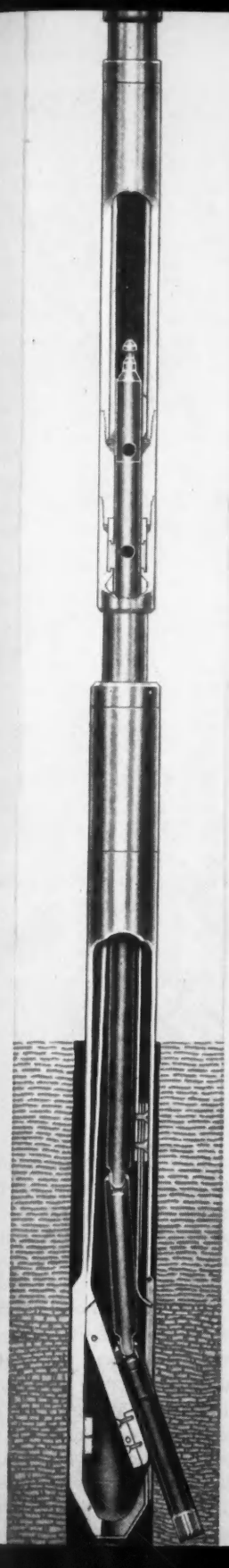
4. There are no data available to show that the sand production started or increased when the salt water production began except in one well.

5. In the initial completion of several of the wells, drilling out of the filler plastic showed only about one-half as much filler left in the hole as there should have been. That is, for example, in squeezing one of the wells, 200 gallons of filler was squeezed into the zone from 5349-59 feet, and in drilling out, the plastic was found from 5352-57 feet. This left three feet at the top and two feet at the bottom of the perforations that might not have been squeezed off with the filler plastic. Though actual details are not available, it is thought that the same thing happened on some of the other wells. It appears that the plastic followed the path of least resistance, all going into the more permeable zones rather than spreading out over the whole perforated section. This information will be used in future squeeze jobs with the filler plastic; the zone perforated will be reduced from 10 feet to 6-8 feet and the filler will be applied in a two-stage squeeze job if necessary, drilling out and testing the first stage for breakdown to see if the second stage is necessary.

Conclusions

The use of the filler and sand-consolidating plastics for consolidating the friable Miocene sands at Choctaw has proved at least partially successful in eight wells. The difficulty that has been experienced is that the present method of squeezing the sands does not give complete and solid consolidated plastic coverage all around the casing perforations. The use of the plastics has made it possible for all the wells to be produced with only a little sand trouble and for two of the wells to be produced with no sand trouble.

From previous experience gained through the use of screens on earlier wells in the Choctaw pool, it appears that the present success being attained with the plastics is equal to or greater than that enjoyed through the use of screens. The installation of a wire-wrapped screen or sand or gravel-packed liner in a well never kept 100 percent of the sand out of the well bore. Sand finer than the smallest openings in the screen was always produced; if an extra fine screen were installed to keep out more of this sand, generally the productive capacity of the well was reduced. Six of the eight wells are now producing water; the beginning of salt water production in a well with a screen installed generally saw the beginning of the sand trouble. Future production history of the eight wells now producing should indicate how the present performance of the plastics is affected by continued production.



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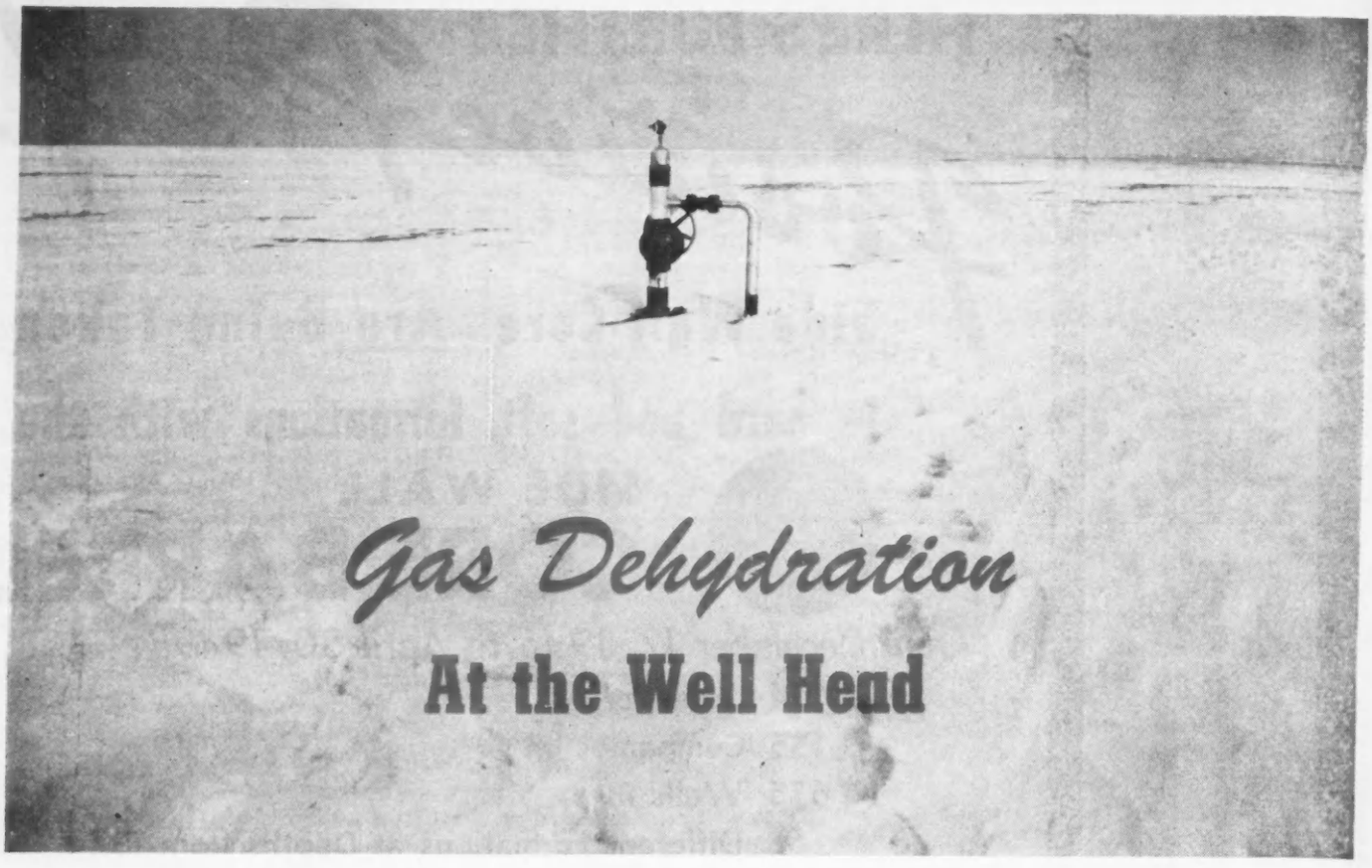

Gas Dehydration At the Well Head

FIGURE 1. Snow-surrounded well head in Hugoton field. Hydrates form readily in extensive gathering systems during cold weather operations.

By LAWTON L. LAURENCE
Head, Development Division, Engineering Department,
Black, Sivalls & Bryson, Inc.
and
LAURANCE S. REID
Professor of Chemical Engineering, University of Oklahoma

THE dehydration of natural gas has been practiced, to a limited extent, since the late 1920's, but it was not until about 1936 that natural gas dehydration processes were developed for widespread use.

Until the present time, however, natural gas dehydration plants have been used almost exclusively for the dehydration of large volumes of gas in cross-country pipe lines. In these applications, the diethylene glycol process has been used extensively where dew points below 20° F. were not required and at gas pressures ranging up to 1000 pounds per square inch gauge. At higher pressures, glycol vaporization losses are usually thought to be excessive.

During the war years, transmission line pressures were increased so that the adsorption process, more commonly known as the "dry" process, has gained in popularity. With this process very low dew points can be obtained at nominal cost for pressures ranging upward from 800 psig. However, the increased operating pressures are usually well within the effective range of the glycol dehydration process. The initial cost of the "dry" type dehydration plant is considerably greater than the cost of diethylene glycol plants. Roughly, this ranges from $1500 to $2000 per million standard cubic feet daily capacity for the "dry" process compared to $750 to $1000 for the glycol process. These approximate costs are based on plants of 10 million standard cubic feet daily capacity, and larger. The unit cost of the conventional processes becomes prohibitive for capacities smaller than approximately 5 million standard cubic feet per day.

THE AUTHORS describe the development of a compact, integrated unit which can be set at the well and which will provide trunk line quality gas without supervision. With a throughput as low as 1 million cubic feet per day, the unit will permit the conservation of gas now lost through difficulties of long-distance transportation of raw gas volumes.

Several attempts have been made to develop a small well-head gas dehydrator, but it has—in most cases—proven too costly for general use, either because of investment or operational costs. There does exist, however, a definite need for an inexpensive well-head gas dehydrator.

The present practice is to employ large units to dehydrate natural gas before it passes into the main line of the transmission system, leaving the gathering system unprotected against costly and bothersome freeze-ups. Since gathering systems usually consist of a network of relatively small diameter pipe lines which operate at higher pressures than the transmission system, it is obvious that dehydration at the well head would be ideal. If such a practice were economical, adequate protection would be provided for the gathering and transmission systems simultaneously.

If an economical gas dehydration unit could be installed at the well head, it would benefit gas producers in areas

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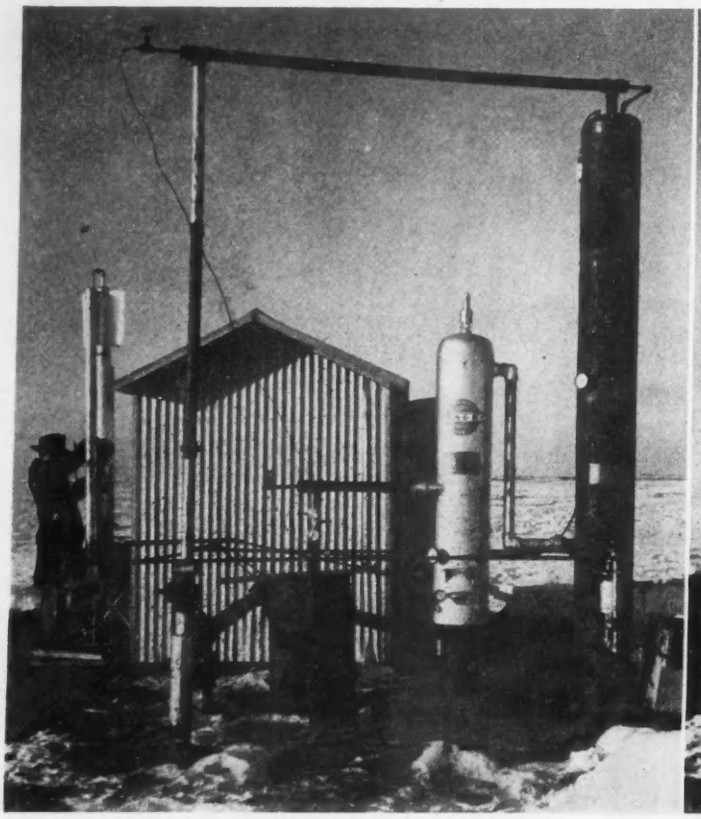

FIGURE 2. Glycol dehydrator test installation at Republic Natural Gas Company's Brower 1, near Hugoton, Kansas, during the past winter.

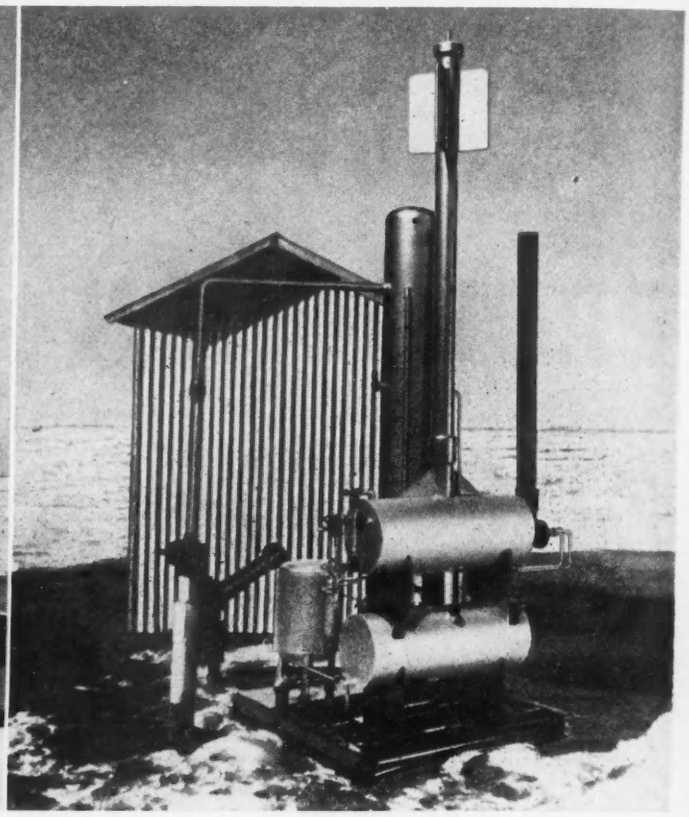

FIGURE 4. An artist's conception of the installation of the standard skid-mounted unit, which has been superimposed on the background setting of Figure 2.

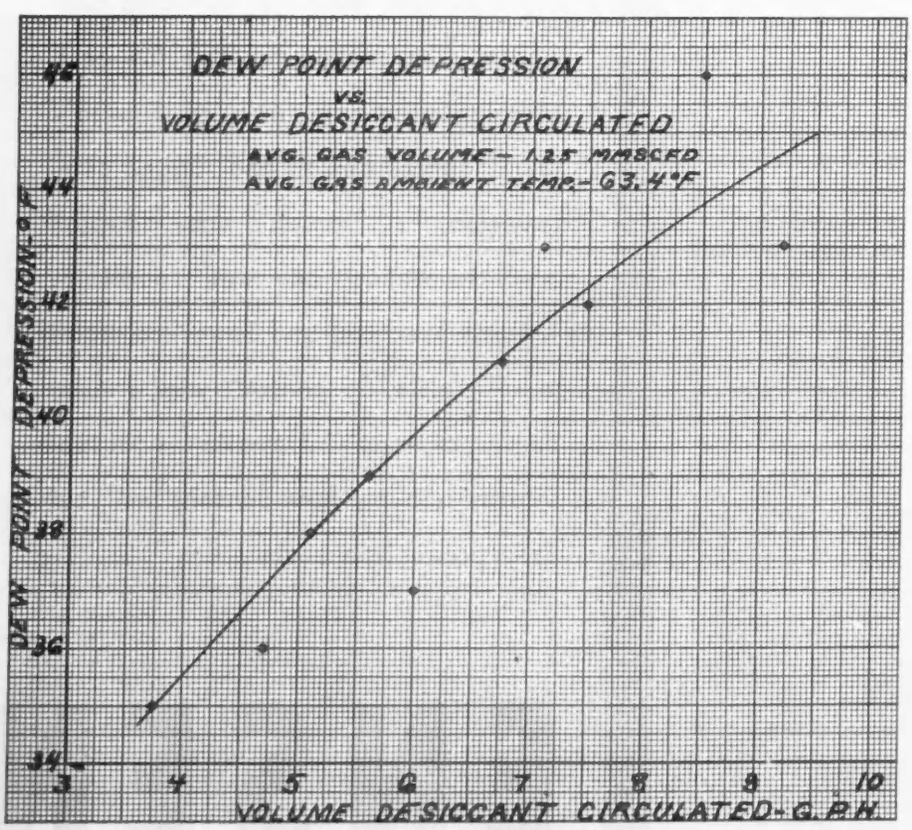

FIGURE 3. Desiccant solution rate vs. dew point depression for 96 percent glycol solution. Stray points are due to changes in solution concentration.

where extensive gathering systems are required and where hydrates form readily during cold weather operations. The economy of such a unit is dependent upon the initial investment, and the cost of maintenance and operation.

Standard Unit

Now a standard well-head gas dehydration unit has been developed and proved to be economically feasible for use in areas where gathering system pressures range up to 750 psig. Similar units are available, on special order, for use at pressures as high as 1200 psig. A glycol desiccant is used in a continuous, automatic process providing a dew point depression of 35° to 45° F. below the ambient temperature of the gas.

The unit consists of an absorber and a regeneration system made up of a reboiler, still column, storage tank and solution pump. Special emphasis was placed on mechanical dependability in an effort to reduce maintenance and operational costs to a minimum. The unit is skid-mounted for installation at the well head, as shown in Figure 4.

The natural gas passes through a well-head drip, or oil and gas separator, in order to remove any free water and liquid hydrocarbons. It then passes through the absorber where it is brought

into intimate contact with the liquid desiccant and gives up its water vapor. The dehydrated gas passes through an efficient mist extractor, and out of the absorber into the line leading to the meter run. The desiccant containing the absorbed water is discharged from the absorber and passes in heat exchange with the hot concentrated solution from the reboiler. Thus preheated, it is discharged into the still column where a portion of its water content is flashed off as steam. The liquid portion flows downward through the still and is discharged to a point beneath the fire tubes in the reboiler. The solution then passes upward past the fire tubes to an overflow type discharge, thence to the storage tank. In the reboiler, the solution is heated to the boiling point, giving off steam and glycol vapors. These vapors are separated by fractional distillation and the water is discharged to the atmosphere as steam.

The concentrated desiccant, which has flowed by gravity from the reboiler to the storage tank, is cooled by heat exchange with the rich desiccant and is returned to the absorber by a gas-powered reciprocating pump.

Dehydrated power and fuel gas for the unit is obtained from the absorber outlet. As a precautionary measure, this gas is pre-heated before its pressure is reduced to prevent any possibility of freeze-ups in the power or fuel gas systems during severe cold weather.

Operating Costs

The operating costs of this unit comprise the cost of the desiccant lost overhead with the water vapor, the desiccant carried away as a vapor in the gas stream, and the cost of the power and fuel gas. These costs are very nominal. The desiccant loss was less than 0.1 pint, and the power and fuel gas consumption were approximately 3000 cubic feet, respectively, per million standard cubic feet of gas treated.

Fundamentally, this unit is similar to conventional glycol dehydration plants, but several unique design features in the solution pump and absorber have made it possible to manufacture these units for capacities as low as 1 and 2 million standard cubic feet per day, at a smaller unit cost than that for most large plants.

Final development work necessary to perfect this unit has been conducted on the Republic Natural Gas Company's No. 1 Brower, near Hugoton, Kansas, during the past winter. One phase of this work is pictured in Figure 2. Operating pressure on the unit has ranged from 350 to 400 psig, processing gas at a rate of approximately 1.5 million standard cubic feet per day. Flowing gas temperatures ranged from 58° to 64° F. during the tests, and the gas was saturated with water vapor at the absorber inlet. Solution pump rates were varied, and outlet gas dew points were obtained while flowing gas at a constant rate. The dew point depression observed is plotted vs. solution pump rate in Figure 3. These data indicate that the absorber performed effectively when using relatively low solution circulating rates. The hydrate formation temperature of the gas at 350 psig is about 47° F. The minimum flowing temperature ordinarily encountered in the Hugoton area, during the winter months, is approximately 37° F. The dew points obtained were considerably lower than this minimum temperature, insuring elimination of hydrate formation in the gathering system.

During the winter of 1947-1948, freeze-ups in the flow line from this well occurred frequently; but, during the past winter, no freeze-ups occurred in this flow line, and no water was collected in the pipe line drips while the dehydration unit was in operation.

The results of this development work were so highly successful that a standard unit design has been evolved. Figure 4 shows a standard unit which is rated at 2 million standard cubic feet daily capacity at 500 p.s.i.g. working pressure.

The cost of these well-head units will be approximately $350 to $700 per million standard cubic feet daily capacity, depending upon the size and working pressure of the unit.

Even in areas of relatively low pressures and low production rates, the payout time on this unit should be reasonably short when computed against the cost of gas lost by blowing down frozen lines, cost of labor required to open frozen lines, lost production from shut-in wells and the cost of alcohol or other hydrate solvents used. Additional savings result from consistently accurate, trouble-free gas measurement, and the elimination of heaters and other expensive pipe line construction features which are often employed to lessen the danger of hydrate formation.

Natural Gasoline Recovery

Another potential source of revenue from well-head gas dehydrators is the recovery of natural gasoline which is ordinarily blown to atmosphere from pipe line drips while removing accumulated water. In many cases the value of this gasoline is sufficient to pay for the gas dehydrators within a relatively short period.

Although it is possible to recover the gasoline without dehydrating the gas, the cost of recovery usually exceeds the value of the product because of continual freezing of both manual and automatic valves used on drips. After the gas has been dehydrated, the natural gasoline may be collected and stored at strategic points on the gathering system with ease, since freezing and water separation problems have been eliminated.

ACKNOWLEDGMENT

The co-operation of C. A. Houy, W. F. Flood and other members of the operating department of the Republic Natural Gas Company at Hugoton, and Gordon S. Bowker, William R. Blake and Rex Vicars of Black, Sivalls & Bryson, Inc., is gratefully acknowledged. Their able assistance contributed a great deal to the success of the field development work.

About the Authors

LAWTON L. LAURENCE attended Cameron Junior College at Lawton, Okla., and was graduated from the University of Oklahoma where he received a B.S. Degree in petroleum engineering in 1941. He immediately became associated with Black, Sivalls & Bryson, Inc. After spending approximately 28 months in the Navy, he went to work in the Research department of The Carter Oil Company, and later returned to BS&B as head of the development division of engineering department. He has devoted much time and effort to the development of natural gas dehydration processes.

LAURANCE S. REID, a native of Iowa, attended Rice Institute and, in 1931, received a B.S. Degree in chemical engineering from Iowa State College. In 1937, he received his master's degree in chemical engineering from the University of Oklahoma. He has worked as refinery engineer with the Lion Oil Refining Company, as research engineer with Phillips Petroleum Company, as development engineer with Black, Sivalls & Bryson, Inc., and as assistant chief engineer with Southern Natural Gas Company. He is now professor of chemical engineering at the University of Oklahoma.

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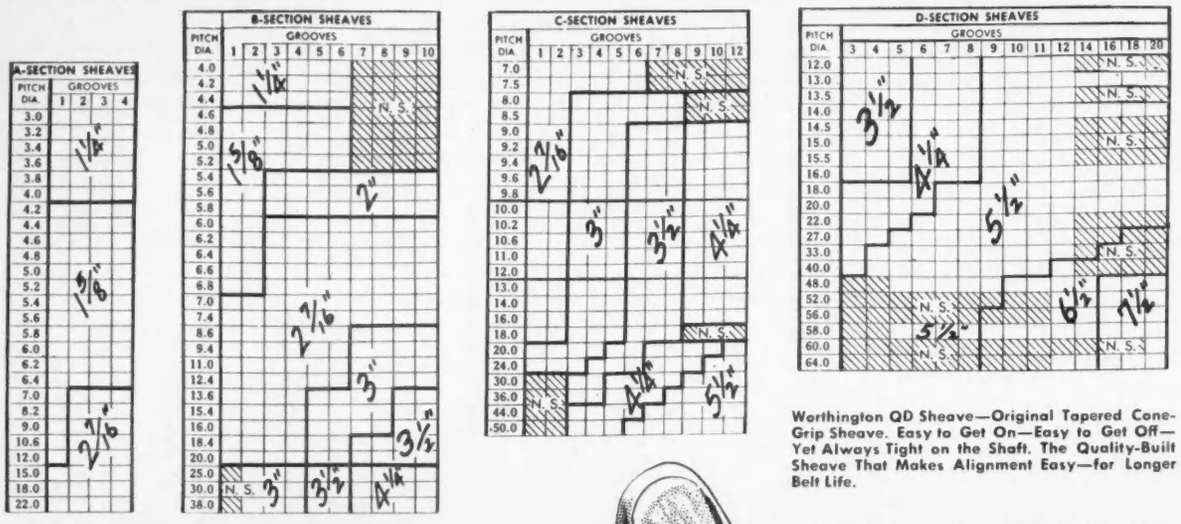

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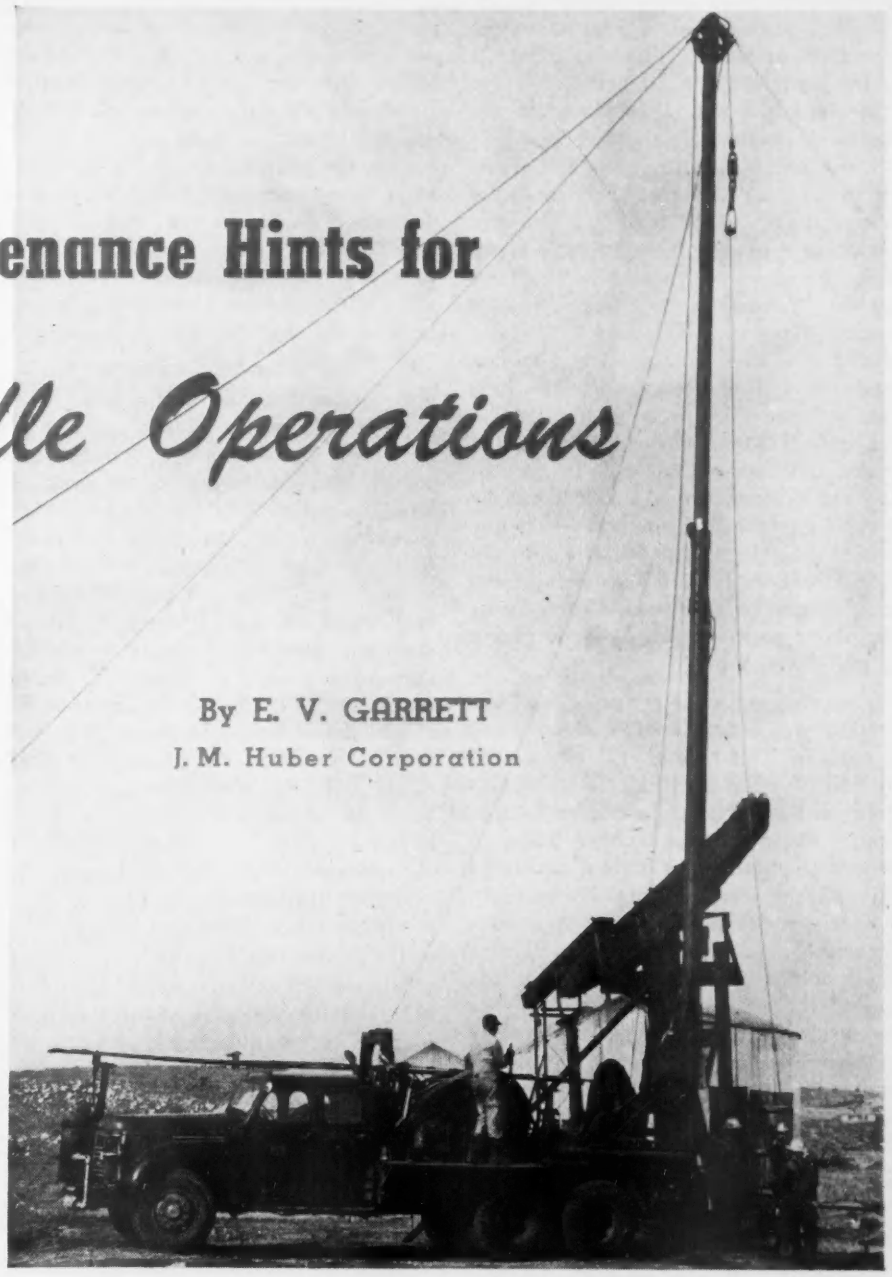
MVD-2B

Well Maintenance Hints for *Panhandle Operations*

By E. V. GARRETT
J. M. Huber Corporation

WHERE WELL servicing is done by the production department personnel, there are numerous points to be watched which can greatly affect the results and the ensuing cost of the operation. In this review of wellhead and down-the-hole conditions, the author points out precautions to be taken and schedules sequence of work.



Truck-mounted pulling unit complete with mast used at location where there is no mast standing

FOR greater efficiency in operating oil-producing properties it is necessary to maintain the well equipment in the best possible condition. Leaky tubing, rod breakage, lead-line trouble, counterbalancing, prime movers and a multitude of lesser evils are all a source of loss of production and, as a consequence of down time, a rise in lifting costs. Since the major proportion of lifting cost is material and labor, it follows that equipment failure should be kept to a minimum. By using individual well checkers, dynamometers, bottom-hole pressure bombs and well study, it is possible to uncover difficulties and to plan the best method of overcoming them.

In pumping wells the tubing is subjected to a series of extensions and compression due to the changing of the fluid load from plunger to tubing. This causes severe stress on the couplings and quite frequently results in leaks around the collars and in many instances causes the tubing to part. In areas where the paraffin conditions are troublesome the tubing becomes plugged. Mud and gas anchors often are a source of trouble due to an accumulation of underground precipitates. When any of the above conditions exist, it is necessary to pull the tubing from the well.

Sucker rods, which are used to transmit the reciprocating motion of the beam to the pump at the bottom of the well, are liable to overload as well as corrode and vibrate; all of which are known to be stress raisers. In the Panhandle the serious effect of hydrogen sulfide on the sucker rods is probably the cause of more rod breaks than any other. Another enemy to a rod string is the fluid pound, whether it be lack of fluid or presence of gas. This condition greatly amplifies the stresses and sets up abnormal vibrations. In case of lack of fluid the remedy is rather simple: become stuck to the extent that the shortening the stroke, reducing strokes per minute or reducing size of pump. The pound as a result of gas requires quite a bit of experimenting to obtain the desired result. In addition to breakage this fluid pound, by allowing slack in the rod will cause the rods to unscrew. In the Panhandle area paraffin is constantly troublesome. This condition exists in varying degrees of severity, but it is not uncommon for wells to have to be stripped at least one a month, a condition which has been largely overcome by using rotating scraper rods.

Pumps being exposed to detrital material produced with the oil become worn and leak, or if the case is severe

tubing must be pulled to clean the pump. The balls and seats, liners and barrels of the pump are also subjected to severe corrosion since the oil produced in the Panhandle is high in hydrogen sulfide content. Gas locks are one of the greatest thieves of production. This condition is not always easily remedied. In case the prime mover is of the variable speed type the gas lock can sometimes be broken by changing the speed of the engine. However, if electricity is employed this is impossible unless a special motor is used. In some cases the lock can be broken by catching the rods at the end of the down stroke with the brake, thus causing the rods to stretch and tap bottom. Other times it can be broken by lowering the rods to allow them to tap the standing valve. As soon as the well is back on production the rods should be re-spaced. When all of the above methods fail, it is necessary to pull the pump.

The greatest maintenance problem present where lead-lines are concerned is paraffin. This condition is aggravated by cold weather. Several methods have been utilized with some degree of success. Oil insoluble rubber balls of proper diameters are being pumped through the lead-lines and retrieved in a specially designed trap at the tanks. Steaming has been employed. Tissue paper folded in balls and placed in the line at the well and pumped down the line has produced some results. In some cases it becomes necessary to break the lines and displace the paraffin at intervals. Since the oil produced in the Panhandle is highly corrosive, the lead-lines are eaten away, thus causing leaks.

Proper counterbalance of oil wells is of great importance. A well not properly counterbalanced subjects all the surface equipment and sub-surface equipment to a series of severe stresses and increases the power consumption. Unless the well is correctly balanced the rods and the pump efficiency are affected and rod breakage is more likely to occur. Several methods are employed to check the counterbalance of a well. Clutch slipping is probably the most common because it requires no equipment and with little experience can be done effectively. By letting the prime mover run at a constant speed and letting the clutch slip, a change in the speed will indicate whether the well is over- or under-balanced, depending on where the change takes effect. If there is no change it may be assumed that the well is balanced.

Balancing by Tachometer

Balancing by use of the tachometer is an efficient means except where large fly wheels are used. The fly wheel tends to keep the crank in constant rotation, which is the basis of this method. Also, on electric motors this method is sometimes erroneous, especially when the motor is not loaded. A method used to very good advantage on electrical installations is the hook-on ammeter. This instrument records the change in electric power on the up and down strokes. The ideal balance would be the same power indication on both the up and the down stroke. The dynamometer can be used but requires technical knowledge before it can be used. The balanced condition is indicated when the maximum and minimum load peaks are directly opposite each other. This is especially true in the second and third order harmonics.

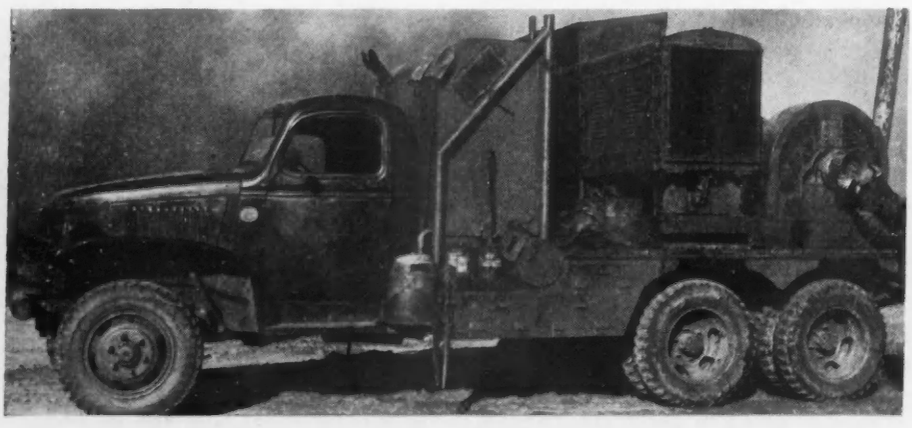
Surface equipment probably requires more maintenance than any of the equipment. Since maintenance is work to prevent breakdowns rather than to repair them, it is wise to set a program and adhere to it strictly. Such things as engines, pump units, radiators and V-belts should be checked daily. Spark plugs should be inspected weekly and cleaned when necessary. The oil in the engine and gear boxes at all times should be clean and cups and gear boxes stocked with the proper lubricants. All working parts of the unit must be well supplied with grease. However, any excess should be wiped off for better operation as well as appearance and safety. The radiators, if inspected and cared for properly, will give good service. They should be free of any detrital agent and also in the winter should be protected from freezing. V-belts must be checked and replaced. If they are housed to prevent weathering and ventilated their life will be greatly extended. The proper belt for each job should be selected and checked for any evidence of slipping or being too tight. All safety devices, such as crank guards and pulley guards, should be checked and maintained in proper repair. Rig bolts and all anchor bolts are to be checked and tightened whenever necessary.

The down-hole maintenance of equipment in the Panhandle, such as pulling rods, tubing, pumps and fishing jobs is very costly. The down time and consequent loss of production as a result of these failures have been responsible for much of the engineering and improvement of the well servicing equipment. The modern portable pulling unit is an outcome of this and has a marked advantage over the old methods of the standard rig days, where speed, efficiency and safety are concerned.

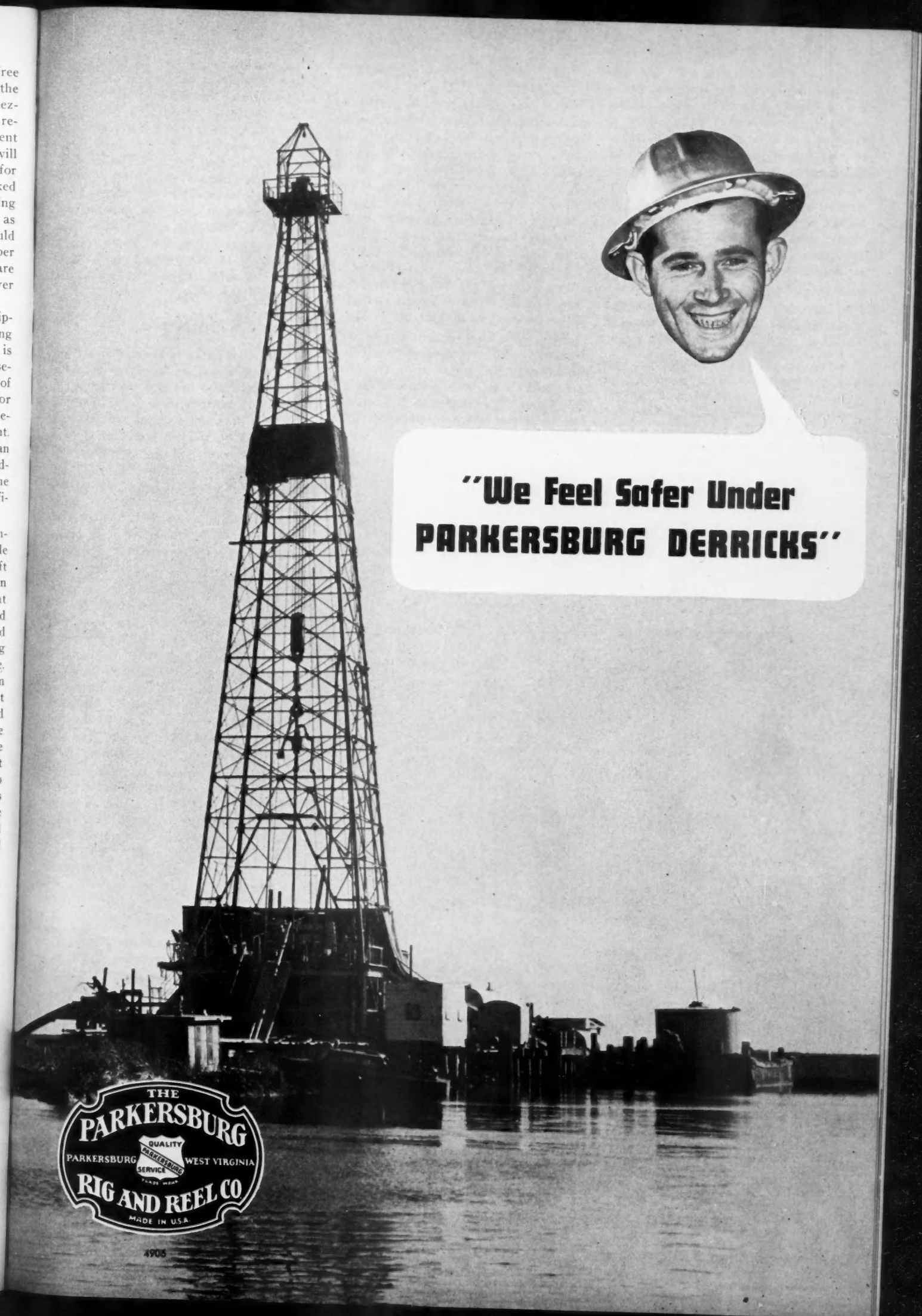
Many of the early wells in the Panhandle area were drilled with cable drilling rigs and these have been left over the hole almost intact. The reason for this was that the operator thought it would be wise because the rig could be used to pull the rods and tubing, and if the well needed cleaning out, the rig could also be used for this purpose. However, with the coming of the modern portable pulling unit and clean-out unit these standard rigs are being replaced with various type pumping units. The operators have found that it is more economical to maintain one pulling unit for a number of wells than to keep several standard rigs in repair. It has been found that a portable rig will be in better repair from constant use and more rapid repair can be given to all wells.

The wells of the Panhandle are pumping from comparatively shallow pay zones. This is ideally suitable to the portable pulling unit with a portable mast. As a consequence of the portable mast, much expense can be saved by eliminating a permanent mast or derrick at the well. Portable units in the Panhandle are mounted on trucks, trailers and tractors, with those on trucks by far the most commonly used. At first these portable units were handicapped by rough ground, but with the building of roads and good locations this handicap has been overcome. These units are powered by either gasoline or diesel engines. The units are manned by three or four men, and it is their job to see that each well is provided with the proper care and attention.

As stated above it becomes necessary



Truck-mounted pulling unit used where mast or derrick is standing.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to pull the rods or tubing from the well in cases of paraffin, broken rods, leaky tubing, worn pumps and sticking pumps. When these conditions exist where a standard rig is located, the preparation of this job is quite simple if the rig has been maintained properly. First to be done is to pull the tubing line over and string up the blocks. This is attached to the elevators and the crew is ready to start the job of pulling rods and tubing. If, however, a portable unit is used where there is no mast, the mast must be raised and guyed and the truck properly secured. To facilitate the portable unit deadmen are usually buried in readiness for any such job.

When the blocks have been strung and the unit has been secured, the polished rod is removed and the remainder of the rods pulled. When the plunger reaches the surface it is washed in distillate or kerosine and inspected. If the plunger shows no signs of wear, it is then necessary to pull the barrel. Pulling the tubing is eliminated when a rod-type pump is used, for it can be pulled with the rods. If the balls and seats are worn or corroded, they can be replaced at the well, but if the plunger is worn it must be taken to an authorized pump shop. Most of the supply stores selling pumps have pump repair shops.

Often the rod string is parted by overloading, corrosion, metal fatigue, defective coupling, or being unscrewed. The upper portion of the rod string is pulled and a combination rod socket is run on the bottom of the fishing string. The socket is then lowered into the well and over the lost rods. When the socket is secure the rods are pulled to the surface and the defective rod replaced. The socket is taken out and the rod string is returned to working position. The socket is made to accommodate either the body of the rod, pin or box.

Frequently when an attempt is made to remove the rods from the well, it is discovered that the rods or the pump are stuck, making it necessary to pull the tubing. This might be the result of one or a combination of reasons listed above such as paraffin, sand or salt.

If the cause is paraffin, it is often necessary to pull the tubing and rods simultaneously and strip the tubing from the rods. This is a frequent and costly job in the Panhandle area, since the fluid levels are low and the paraffin deposits are deep. When the job is complete the tubing and rods are steamed before they are returned to the well. This condition has largely been overcome by applying scrapers at equal distances on each rod down to and slightly below the point of paraffin deposition and rotating the complete rod string a fraction of a turn with each reciprocation of the unit pumper. The rotating of the rod string is done by a rotating rod hanger attached to the polished rod by casehardened slips. The unit pumper imparts the rotating motion through a ratchet-toothed turntable applied horizontally below the rotating rod hanger, and a pull cable attached to the ratchet lever and the beam.

Rotating head for driving scrapers applied to sucker rods.

Freeing Pump

When the pump is stuck due to salt, the pump might be freed by pumping fresh water into the well and letting it remain on bottom to dissolve the salt.

If this does not free the pump it can sometimes be worked free, but caution should be exercised not to allow the rods to stretch and thus be ruined. In the case of sand the pump sometimes can be freed by working, but again caution should be used. If the sticking pump cannot be freed and it is necessary to pull the tubing the following steps are taken:

The rods are backed off as far down the hole as possible and then removed and preparation to pull the tubing must be made. The tubing blocks and elevator are strung up and the tubing is removed in singles, doubles or trebles, as in the case of the rods and laid down on racks built for this purpose. The tubing is pulled and the remainder of the rods are backed off, if possible, and laid down, then more of the tubing is removed. This process is repeated until all of the rods and tubing are removed from the well. While the rods and tubing are out of the well it is wise to do some remedial work to prevent recurrence of this situation. After this is done the tubing and rods are returned to the well and the unit started. The crew will remain at the well until the well is back on production.

The tubing, being subject to a series of stress reversals coupled with corrosion and wear, often parts or leaks. If it is leaking the rods are pulled and then the tubing until the leak is found and repaired. Then it is again lowered into the well. If the tubing has parted the rods are pulled and that portion of the tubing above the part. A tubing spear is then run on the tubing to fish for the tubing left in the well. When the fish is located and the spear is secure the remainder of the tubing is pulled to the surface and the bad joint or joints replaced and the tubing and rods are again lowered into pumping position.

SOUTHWEST

A NEW SLUSH PUMP PISTON WITH SNAP BACK ACTION

Gets the right rubber for the job from Murray!

The Southwest PISTON features a patented operating principle in which the rubber lip of the piston snaps free from the liner at the end of the pressure stroke. Thus, the rubber lip of The Southwest Piston flexes or bends thousands of times during a normal day's operation . . . millions of times during a normal service life.

Murray engineers, working with The Southwest Company, developed the right rubber for this job as they have for many other oil equipment manufacturers with difficult rubber compounding and molding problems. We invite you to bring your rubber problems to Murray for a prompt and economical solution. We specialize in the production of rubber—natural and synthetic—for the oil industry.

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Primary Factors in *Reservoir Engineering*

By WARD M. EDINGER
Production Engineering Laboratories, Oklahoma City

EVALUATION OF oil and gas reservoirs and ways and means of attaining maximum recovery in the most efficient manner are the primary concerns of the reservoir engineer. Specifically, it is his function to calculate the reserves under a given tract and to predict with reasonable accuracy the ultimate recovery to be anticipated by various methods of maps and similar information.

RESERVES are divided for convenience into liquid phase and gas phase reservoirs. The most common type of depletion process is the gas expansion method in which the principal source of energy is the gas contained in the solution in the crude under bottom hole conditions.

This type of reservoir is saturated or undersaturated according to whether or not it contains all the gas possible under those conditions. The saturated reservoir is usually, but not necessarily, in equilibrium with a free gas cap. The dividing line between saturated and undersaturated crudes is not as definite as previously thought for there is evidence in certain fields that the crude is saturated at the gas-oil interface region but undersaturated at points lower in the oil column. It is thought that the cap rock in these cases allows minute quantities of gas to escape and that the reservoir is not necessarily in equilibrium. In any event, as the pressure declines due to withdrawals from the volumetric field the source of energy is the compressibility of the fluids in place until the bubble point pressure is reached, at which time the gas comes out of solution forcing oil and gas into the well bore. The gas-oil ratios increase and reach a maximum value at some subsequent date and then in turn decline as the gas becomes dissipated.

The ultimate recovery from the volumetric type reservoir is generally low, and the process is not particularly efficient. The ultimate recovery, expressed as percent of stock tank oil in place, is directly proportional to some function of the saturation, or bubble point pressure, and inversely proportional to some function of the bottom hole viscosity. Other elements act to reduce this recovery, particularly in low productivity index wells where excessive gas saturation in the vicinity of the well favors abnormal gas-oil ratios and a non-uniform saturation distribution around the well. The usual recovery factors vary from 10 to 30 percent of the oil in place. In terms of the pore space, or reservoir fluid in place, the advantage of high pressure is usually offset by high shrinkage factors, and this effect is quite pronounced in reservoirs over 4000 feet in depth. The presence of a free gas cap furnishes an additional source of energy which is helpful in the recovery mechanism. This factor may be offset by capillary rise of the fluid into the gas cap and losses due to saturating the gas phase reservoir unless pressure maintenance is practiced.

Reservoir liquids may be recovered by the more efficient method of water displacement in which edge water encroachment displaces a large portion of the oil, leaving a residual or non-recoverable oil content. This mechanism frequently recovers up to 50 and 60 percent of the oil in place or even higher. The recovery is directly proportional to the invasion factor and inversely proportional to the residual saturation. The oil in place in turn is governed by the amount of pore space occupied by oil instead of connate water and the shrinkage factor, while the invasion factor is governed by the path of movement of the water and distribution of the permeability. The residual saturation depends largely on the bottom hole viscosity and its change during the life of the field as well as distribution of pore size and other characteristics of the rock. If the field enjoys an active water drive sufficient to maintain pressures during depletion, the recovery will be higher than otherwise since gas will remain in solution in the reservoir and maintain a lower bottom hole viscosity. Ratios will remain near solution ratios under perfect conditions but will rise and approach volumetric behavior if the drive is insufficient. In the latter case we have a combination of retarded volumetric behavior and water drive behavior.

Gravity Drainage

Gravity drainage is said to control a reservoir if, after dissipating the gas, oil is still produced at commercial rates without benefit of a water drive. The conditions favoring gravity drainage are high structural relief and/or large effective sand thicknesses, which factors allow segregation with oil moving down dip. A

About the Author

WARD M. EDINGER was graduated from the New Mexico Military Institute, Roswell, N. M., in 1931 and then attended the University of Missouri, from which he received a degree of B.S. in chemical engineering in 1935. He was employed by Sinclair Prairie Oil Company from 1935 to 1938 as core analysis technician and chemist. He went to work for Core Laboratories, Inc., Dallas, in charge of portable field laboratory and later became division engineer for Oklahoma and West Texas. In 1946 he became chief engineer for Harper and Turner, Oklahoma City, but resigned late that year to establish Production Engineering Laboratories.

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FOR SECONDARY RECOVERY!

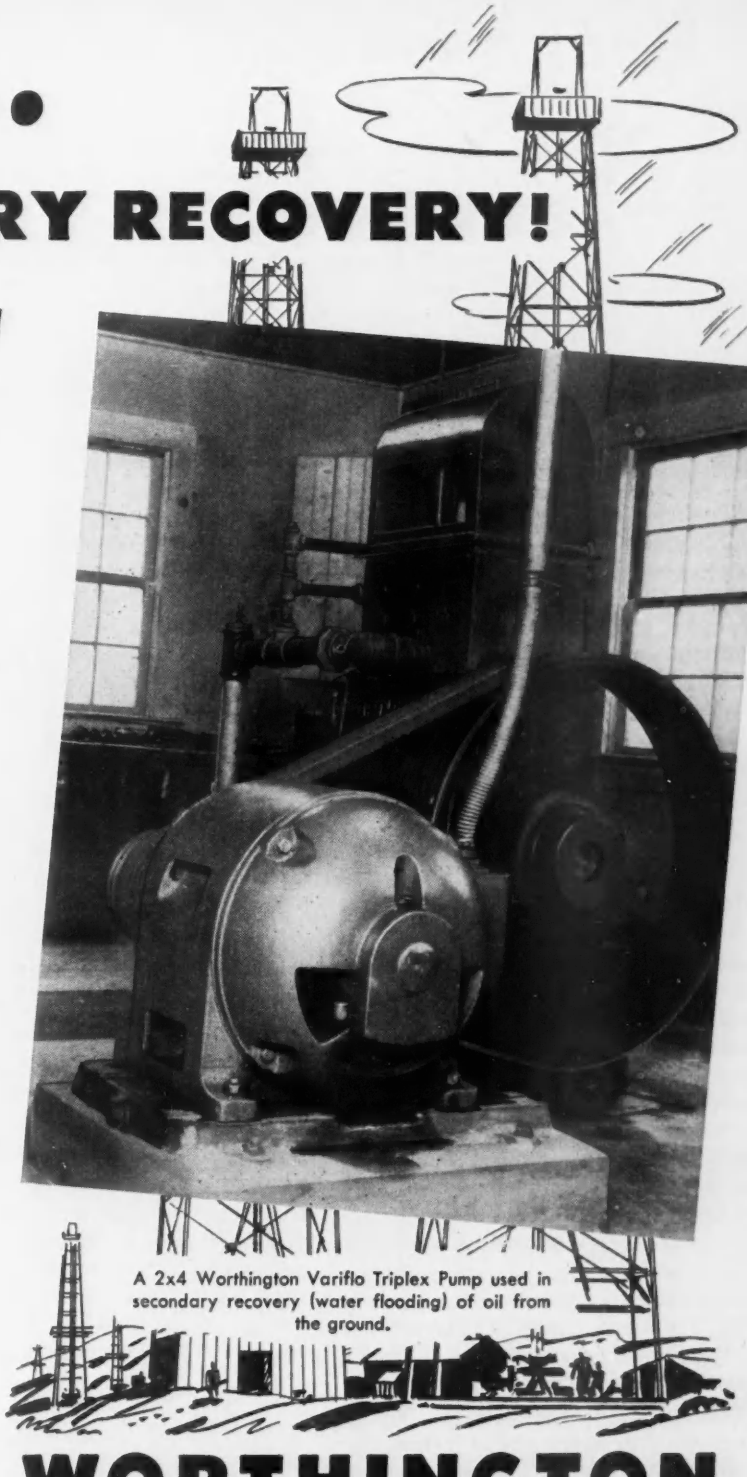
There's nothing like a Worthington Variflo for water flooding

Back in the days of oil field pioneering Worthington found that *constant* water pressure was needed to displace recoverable oil — and that any reduction of pressure meant loss of production. Because the ordinary pumps used for this service were also doing other water-pumping jobs, pressure was constantly fluctuating — and recoverable oil was being lost.

Worthington Found The Answer in Variflo Triplex Pumps. Providing constant pressure at all times, Variflos automatically vary their capacities to compensate for water withdrawn *for any other purpose.*

Operating on any standard air-type pressure controller, Worthington Variflo Pumps bring stepless, automatic variation — *from zero to 100%*. Except for the variable capacity feature, Worthington VTE Pumps offer the same advantages in constant capacity design.

Exclusive Features make Variflos and VTE's the most efficient money-savers in many other oil field applications. For further facts proving *there's more worth in Worthington*, write to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.*

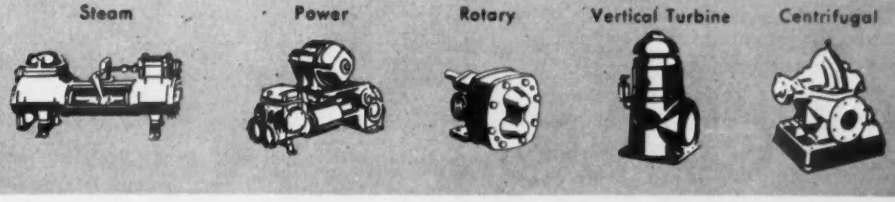


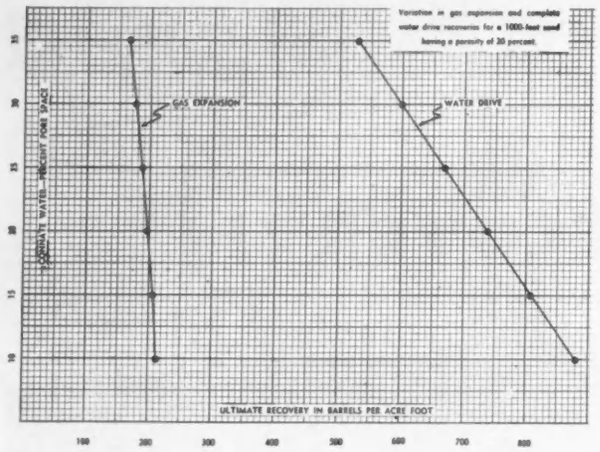
A 2x4 Worthington Variflo Triplex Pump used in secondary recovery (water flooding) of oil from the ground.

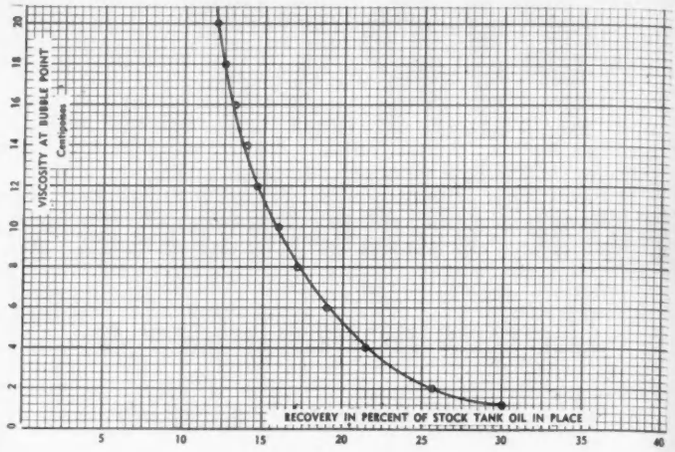
WORTHINGTON

P8-7

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB




Variation in gas expansion and complete water drive recoveries for a 1000-foot sand having a porosity of 20 percent.
GAS EXPANSION
WATER DRIVE
ULTIMATE RECOVERY IN BARRELS PER ACRE FOOT



(Right) Ultimate recovery for a volumetric reservoir at 3000 feet as a function of bubble point viscosity.

high permeability to viscosity ratio, or mobility index, is essential. Gravity segregation probably occurs to some extent in all volumetric reservoirs and particularly in stripper production. Under favorable conditions this mechanism is probably the most efficient natural process with possible recoveries as high as 80 percent of the oil in place, although in certain stripper areas the effect is relatively unimportant due to lack of some of above factors.

Types of Reservoirs

Gas phase reservoirs are divided into retrograde and non-retrograde types. Retrograde reservoirs produce condensate at reservoir temperatures on reduction of pressure. The factors that influence recoveries are principally the composition of the hydrocarbons and their behavior under pressure decline. As the dew point is reached condensation may occur in the reservoir, particularly near the well bore where the principal pressure drop occurs. Retrograde reservoirs frequently have different compositions at different points in the reservoir and the amount and character of the condensate is influenced by the flow characteristics of the individual wells as well as the reservoir.

Non-retrograde reservoirs are simple cases of a pressure vessel being bled down. Boyles law, with appropriate corrections for deviations, expresses the behavior of this type of reservoir.

The reservoir engineer is concerned with other mechanisms of depletion commonly known as secondary recovery. Liquid phase reservoirs may be gas or air repressured. In the event the pressure is maintained at or near original conditions, the reservoir enjoys some small benefits from direct displacement of the oil phase by the gas phase. The efficiency of this displacing mechanism, however, is not high, and the reservoir ultimately produces at ratios approaching input ratios. A more beneficial result is obtained by returning a portion of the gas and thereby enjoying the primary volumetric recovery and a sustained flowing life of the field. Pumping is thus deferred and lifting costs reduced. The produced gas may also be processed for natural gasoline, and the dry or residue gas returned to the reservoir. Returning the gas to the reservoir gas cap, if one exists, is beneficial since the oil phase is thereby prevented from wetting the gas zone. Pressure is exerted downward favoring segregation and enforced gravity drainage if proper control of produced ratios is maintained by sound operating practice.

Artificial water injection is widely practiced either as supplementing edge water encroachment and creating a rising water table or by pattern flooding. The former practice, if applicable, allows a high ultimate recovery with reduced lifting costs and a high degree of invasion. At shallower depths the common practice is pattern flooding with alternate wells being injection wells. The most common pattern is the so-called five-spot with one producing well at the center of the unit surrounded on four corners with the four input wells. Each input well theoretically passes one fourth of its flux to the unit so in effect there is one input to one producer. The offset units each receive their one-fourth of the flux, so the five-spot consists of alternate rows of injection and producing wells, offset, equidistanced input to input and producer to producer. A ten-acre unit would consist of four input wells 660 feet apart with a center well 467 feet from each corner. There are other patterns such as the line drive, the seven-spot, etc., each having its advantages and disadvantages according to its coverage factor and conductivity factor. The coverage factor for a five-spot is 72 percent, theoretically, or 72 percent of the area in the unit covered. The vertical displacement factors on the other hand are controlled by the uniformity of the sand. Uniform permeability favors a higher recovery since each portion of the exposed reservoir will take water in direct proportion to its permeability to water. A heterogeneous reservoir with high bottom hole viscosity favors early water cuts and poor recovery, whereas a homogeneous reservoir with low viscosity favors high recovery with delayed water cutting. The heterogeneity of the reser-

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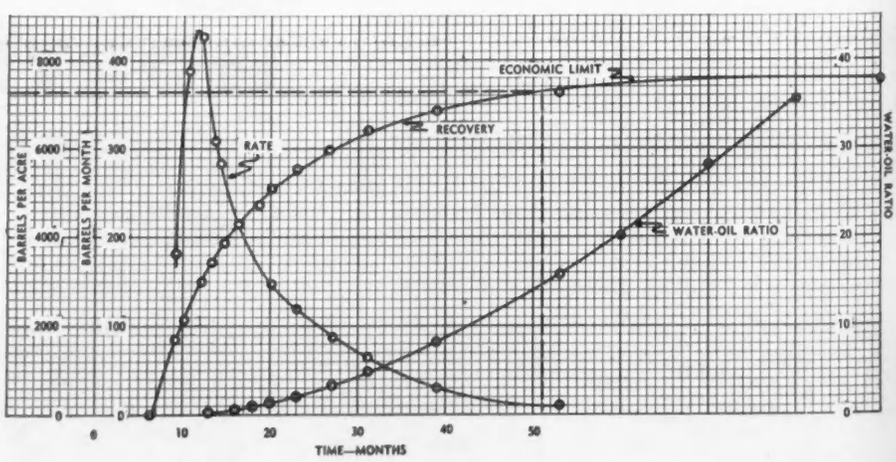


History of five-spot water flood calculated from permeability distribution for assumed rate of water intake—440-foot spacing.

D+B Rod Liner PUMPS

FOR THE MOST SEVERE PUMPING SERVICE
WHERE ONLY FINEST QUALITY PUMPS SURVIVE

D+B Rod Sectional Liner Pumps are designed, engineered and constructed to provide efficient and economical service under the most severe operating conditions. The precision sectional liner provides a straight, true liner column through which plunger can operate freely.

The advanced design, combined with use of highest quality materials and precision workmanship make D+B Rod Liner Pumps unsurpassed for efficient handling of gassy, sandy or corrosive production from "problem" wells. They are available in a full range of sizes and lengths, with any desired combination of fittings to efficiently pump from any depth in any well condition—a fitting complement to the world famous D+B line of deep well pumps and sucker rods.

STATIONARY BARREL WITH TOP OR BOTTOM HOLD-DOWN

Recommended for corrosive, sandy or gassy production from crooked or slant holes. Regularly equipped with chrome-plated plungers, H-C-I or "Endurall" liners, double valves, Armored or Endurall closed cages, and Superloy balls and seats. Available with either 3-cup or exclusive D+B Simplex top or bottom lock hold-down.

TRAVELING BARREL WITH BOTTOM HOLD-DOWN

Recommended for gassy and sandy production. Particularly effective in moderate sandy conditions with intermittent operation. Standard equipment includes chrome-plated plungers, H-C-I or "Endurall" liners, double valves, Armored closed cages and Superloy balls and seats. Available with 3-cup, A.P.I. or exclusive D+B Simplex bottom lock hold-down.

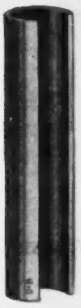
TRAVELING BARREL CHAMPION WITH BOTTOM HOLD-DOWN

An inverted insert type pump with either 2 or 3 liners and extension tube. Plunger acts as both pull tube and plunger, reducing number of parts and joints. Recommended for sand, shale, or corrosive well conditions. Wiping action of short liner column prevents intrusion of sand between working surfaces. Oversize standing valve, connected to upper end of plunger, permits free, unobstructed fluid flow.

CHROME-PLATED PLUNGERS

All D+B Rod Liner Pumps are normally equipped with chrome-plated plungers. They are made from thick-walled, seamless steel tubing, heavily chrome plated. They are accurately ground and polished to size and fit desired to assure a perfect seal. D+B "Endurall" plungers for extreme corrosive service may be used.

LINERS



Hardened cast iron (H-C-I) liners for ordinary pumping, or stainless steel "Endurall" liners for severe service, are normally supplied with D+B Rod Liner Pumps. All D+B liners are centrifugally cast to provide a uniform dense structure free from impurities. They are honed to a mirror-like finish and have a precisely controlled hardness for maximum wear resistance. Standard and Armored liners are available.

DOUBLE VALVE ASSEMBLY

D+B Rod Sectional Liner Pumps are equipped with double valve assemblies. They are designed to permit free, unobstructed fluid flow and to provide correct amount of ball lift and side clearance. Gas spinning of ball is eliminated. In operation, the double valve assembly insures perfect seating and long, trouble-free service.

For additional information on D+B Rod Liner Pumps ask for Bulletin No. 611-A

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D+B

DEEP WELL PUMPS AND SUCKER RODS

BY PARK J. JONES
Consultant, Houston

Oil Production by Gas and Flooding

Part 8

DISPLACEMENT OF OIL BY FLOODING

FLOODING is oil production by water at reservoir pressures considerably less than saturation pressures for oil. The oil recoverable by flooding varies with the oil recovered by gas, shrinkage of the oil not recovered by gas and the location of wells. Cumulative oil recovery at a given time in the life of a flooding project may be influenced significantly by the oil retained, filtered out, by the acre-feet of pay not invaded by water. The displacement of oil by water herein considered is used in estimating flooding reserves.

Relative Permeability

The approximate relative permeability K_o to a reservoir liquid, and K_w to water, is defined[1] by

$$K_o = (1 - 1.11C)^2 \qquad (1)$$

and

$$K_w = C^3 \qquad (2)$$

where C is displaced oil. The curves in Figure 8-1 are solutions of the foregoing equations. The data are for displacement of oil by water from a uniformly-permeable section at pressures not less than the saturation pressures for an oil. Displaced oil is expressed as a fraction of initially in place oil.

Water-Oil Ratio

Let R be the ratio of water to oil in the production from a uniformly-permeable section. Then

$$R = \frac{bQ_w}{Q_o} = \frac{b\mu_o}{\mu_w} \cdot \frac{C^3}{(1-1.11C)^2} \qquad (3)$$

The curves in Figure 8-2 are solutions of equation (3). The fluid factor $b\mu_o/\mu_w$ is denoted by F and oil recovery from a uniformly-permeable section is plotted against the barrels of water per barrel of oil from the section. Note that 100 barrels of water are required to recover an additional barrel of oil for displacements in the range from 70 to 80 percent of in place oil even if a section were uniformly-permeable.

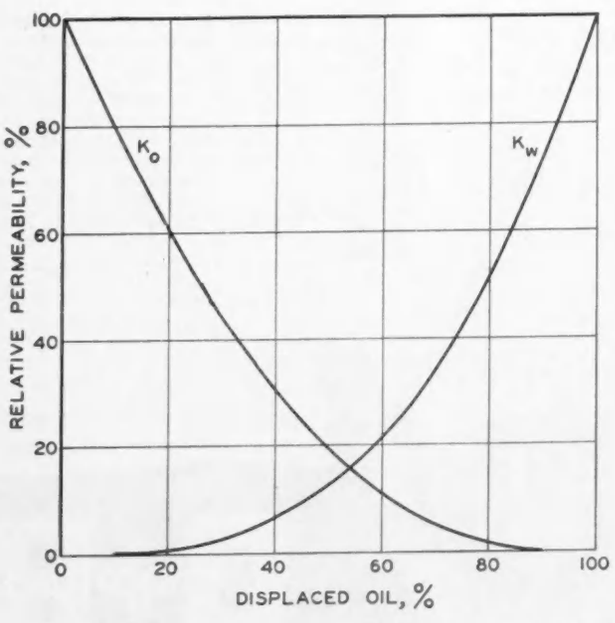
Breakthrough and Maximum Recoveries

The oil displaced from a section at the time the section starts producing water is called the breakthrough oil recovery U_b. This recovery in a field is not likely to be greater than the percent recovery defined by

$$U_b = 28 - F \qquad (4)$$

where F is the fluid factor.

The oil displaced from a section with



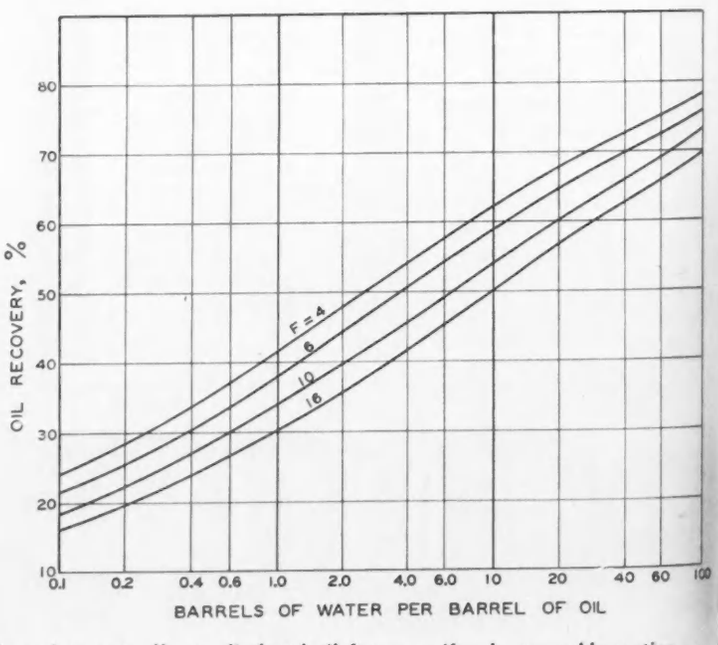


FIGURE 8-1 (Left). Relative permeability to a reservoir liquid K_o and to water K_w vs. displaced oil from a uniformly-permeable section.
FIGURE 8-2 (Right). Displaced oil vs. fluid factor F and barrels of water per barrel of oil in the production from a uniformly-permeable section.

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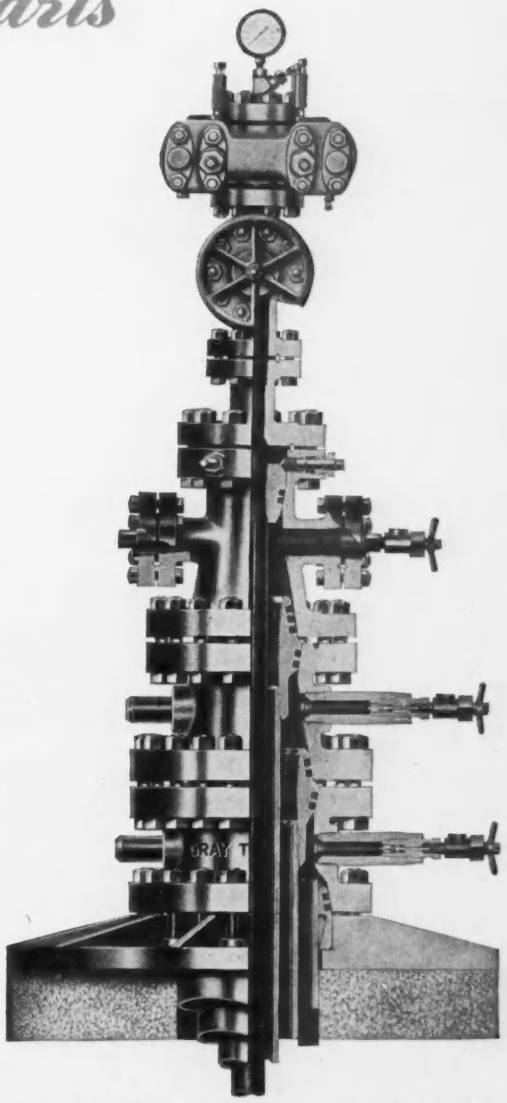

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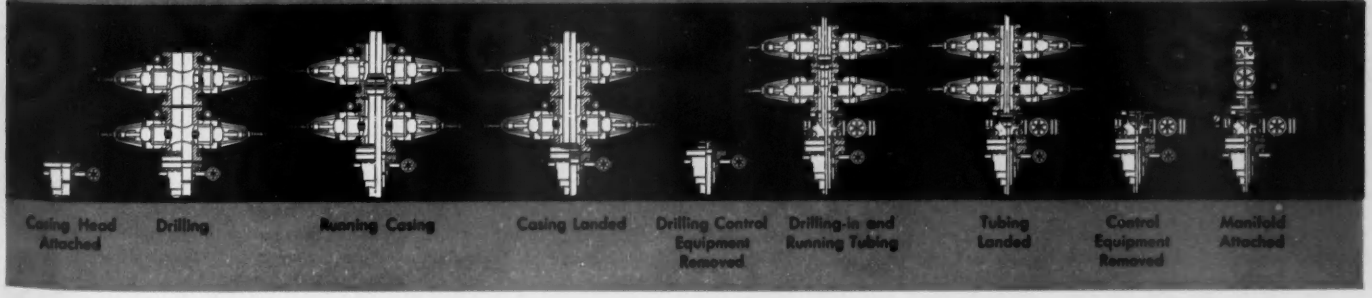

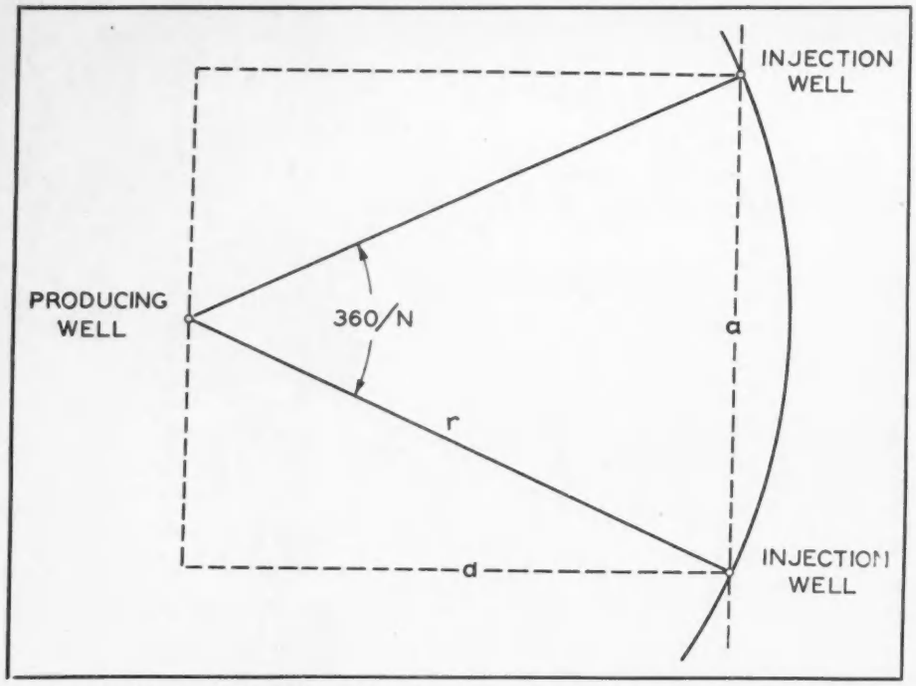

FIGURE 8-3. Sketch showing a portion of either a radial, solid lines, or of a rectangular, dashed lines, flooding system.

a practical total volume of water through the section is called the maximum oil recovery U_o. A section at any level in oil has variable permeability. The latter varies along the strike on a given bed and between beds at a given level. Consequently, water migrates through localized portions of a section. The localized portions of sections are channels or paths having comparatively high conductance. The maximum oil recovery from localized portions of a section may approach the recoveries shown in Figure 8-2. But field experience indicates that the oil recovery from a section as a whole is not likely to exceed the recovery defined by

$$U_o = 80 - F \qquad (5)$$

The B and M Contours

The elevation that shows the position of an oil-water interface is called the B contour. Oil recovery from the acre-feet of pay in the vicinity of a B contour is (28 — F) aside from shrinkage of reservoir liquid.

The position in a reservoir of a section of maximum oil recovery is denoted by a contour called M. Oil recovery from the acre-feet in the vicinity of an M contour is (80 — F) aside from shrinkage.

The position of a B contour is about 1000C feet updip from an M contour[2] where

$$C = \frac{2A}{A + a} \qquad (6)$$

and A is the productive area intercepted by a horizontal plane at the elevation M and "a" is the corresponding area at an elevation which is 1000 feet updip from M along the top of pay. The symbol C is convergence of reserve. As an example, if a = A within a 1000-foot interval along top of pay, convergence would equal unity and the position of the B contour, oil-water interface, would be approximately 1000 feet updip from the M contour. Conversely, the position of the M contour would be 1000 feet downdip from the B contour. These considerations are aside from producing water. Production of water from a B-M region advances the position of an M contour relative to its B contour and decreases the acre-feet of pay within a B-M region.

Recoverable Oil for No Shrinkage

The oil displaceable by water from the acre-feet of pay on the downdip side of an M contour is about (80 — F). The acre-feet of pay within a set of B and M contours is called the B-M region. The displacement factor m, oil recovery, for a B-M region aside from shrinkage is defined[2] by

$$m = \frac{1}{6}\left[U_o(C + 2) + U_b(4 - C)\right] \qquad (7)$$

where m is in percent of in place oil.

Convergence of reserve for updip displacement of oil ranges from about unity

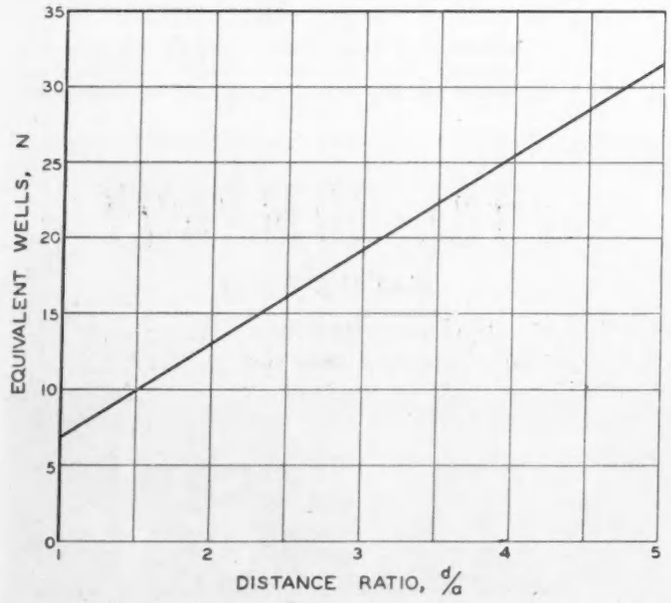

FIGURE 8-4. Equivalent number of wells vs. the ratio of the distance "d" between rows of producing and injection wells to distance "a" between wells on a row.

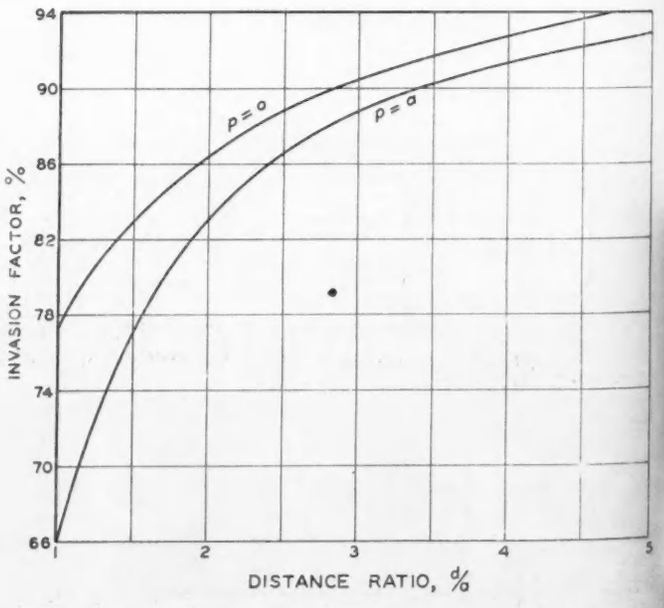

FIGURE 8-5. Invasion factor for the B contour vs. the ratio of the distance "d" between producing and injection rows to "a" the distance between injection wells in a row.

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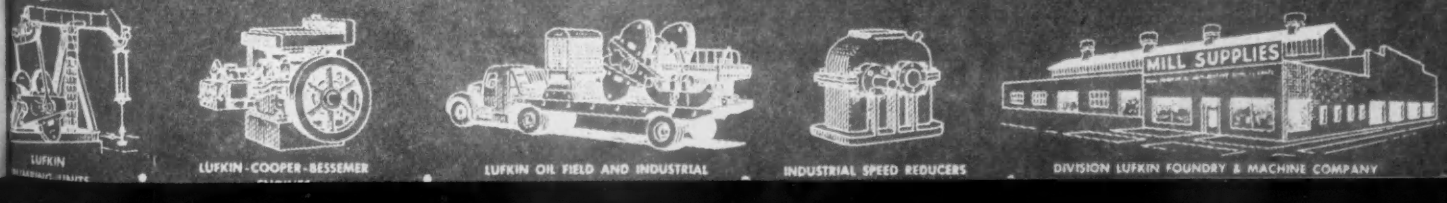

in the vicinity of a water contact to about 2.0 at the updip productive limit for reservoirs having no primary gas cap. Upon substituting $(28 - F)$ for U_b and $(80 - F)$ for U_o, equation (7) gives

$$m = 45.3 + 8.7C - F \qquad (8)$$

The total oil recovery is the sum of the recoveries from a B-M region and from the acre-feet of pay downdip from an M contour. The oil recoverable by flooding is the oil recoverable by pressure maintenance with water less the oil recovered by gas less a correction for shrinkage of reservoir liquid.

Displaceable Oil by Gas and Water

A pressure decline increases the viscosity of a reservoir liquid by virtue of vaporization. The ratio of the increased viscosity to that at saturation pressure may range from, say, 1.2 to possibly 3.0 depending on the degree of vaporization. However, an increased viscosity tends to be compensated by a decreased volume factor for the reservoir liquid being displaced at a declined pressure.

Free gas saturation should also be considered for reservoirs from which some oil recovery by gas is followed by water encroachment or flooding. An increased fluid factor tends to decrease ultimate oil recovery aside from nondisplacement of evolved solution gas. But all of the free gas may not be displaced by water. Accordingly, the influence of an increased fluid factor on the ultimate oil recovery by gas and water tends to be compensated by non-displacement of some free gas. Non-displacement of free gas by water is probably on the order of 2 percent of porosity divided by reservoir space. That is, water can displace about 98 percent of in place gas aside from the presence of a reservoir liquid. For these reasons it appears that the loss of oil for displacement by water at declined pressures is attributable almost entirely to shrinkage.

Let U be the displaceable oil by water aside from shrinkage. Let U_s be the oil displaceable by gas plus water after shrinkage. Then $(1 - U)b_o$, the remaining reservoir liquid aside from shrinkage, equals $(1 - U_s)b$, the corresponding value after shrinkage. Accordingly, the oil recoverable by gas and flooding is defined approximately by

$$U_s = 1 - (1 - U)b_o/b \qquad (9)$$

where b_o/b is the ratio of volume factors and U_s includes the oil recovered by gas.

Let U_f equal the oil displaceable by flooding at a declined pressure. Then

$$U_f = U_s - U_g = 1 - U_g - (1 - U)b_o/b \qquad (10)$$

where U_g is the oil recovered by gas. Equation (10) represents the sum of per-section oil recoveries by flooding. Procedures for estimating ultimate oil recovery by flooding will now be developed.

The M Region

The acre-feet of oil pay between the source of water and an M contour is called the M region. The oil U displaceable by water from an M region aside from shrinkage is about $(80 - F)$. By equation (10), the oil recoverable by flooding from an M region is defined approximately by

$$U_f = 100 - U_g - (20 + F)b_o/b \qquad (11)$$

where U_f and U_g are in percent of in place oil. If the fluid factor at saturation pressure were five, the ratio of volume factors at a declined pressure were 1.2 and oil recovery by solution gas were 20 percent, the oil recoverable from a completely flooded, or M, region would not be likely to exceed

$$U_f = 100 - 20 - (25)(1.2) = 50$$

The cumulative oil flooded out of an M region is given by

$$C_m = 0.01 p V_m U_f \qquad (12)$$

where

C_m = barrels of oil
p = in place oil, barrels per acre-foot
V_m = acre-feet within an M region
U_f = percent of in place oil displaceable by flooding.

The acre-feet of oil pay within an M region depend on the distance between producing and injection wells and on the volume of injected water.

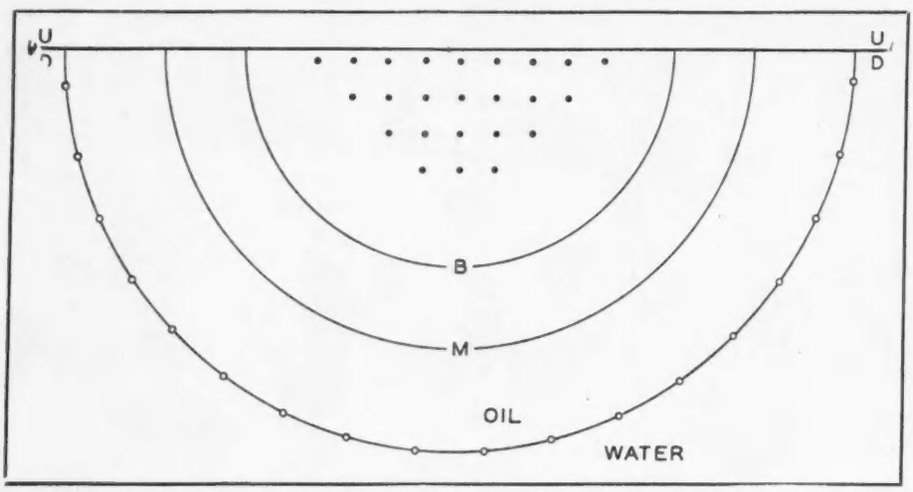

FIGURE 8-6. Illustrating one producing unit with 18 injection and 24 producing wells for a radial reservoir; the "B" contour indicates a position of the oil-water interface; all the oil recoverable by water has been displaced from the downdip side of the "M" contour.

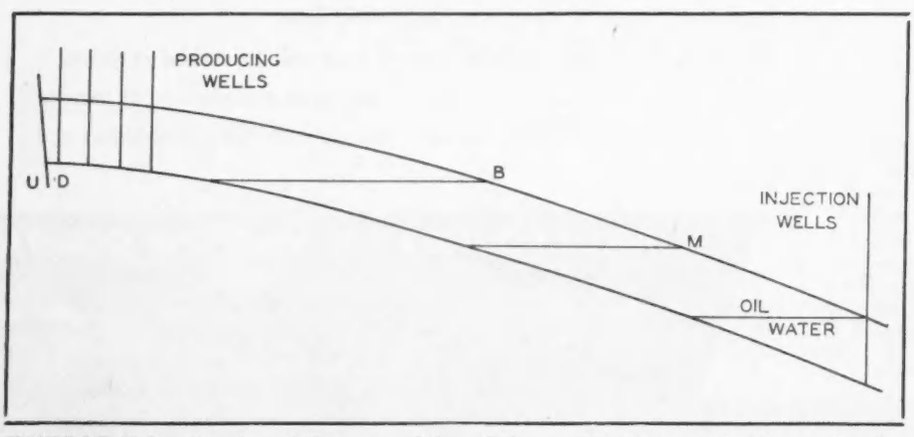

FIGURE 8-7. N-S section through the center of the radial reservoir in the preceding figure; elevation of oil-water interface at "B"; all recoverable oil is displaced from the downdip side of the "M" level.

The Breakthrough Invasion Factor

The position of an oil-water interface is indicated by the B contour. At the time water first appears in production, a B contour has reached a producing well. Breakthrough of water into a producing well is via the bed having the fastest rate of depletion. Other things equal, breakthrough is via the most permeable bed. However, if per-bed producing rates are controlled, breakthrough is via the bed having the fastest rate of depletion which is not necessarily in the most permeable bed.

The acre-feet of oil pay within a breakthrough B contour divided by the acre-feet of oil pay within a breakthrough bed to be invaded by water is the breakthrough invasion factor. The latter varies with the location of producing and injection wells. Figure

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8-3 is a sketch of two different methods of locating injection wells with respect to producing wells. The solid lines represent a radial system. The dashed lines indicate alternate rows of producing and injection wells.

Consider a radial reservoir. Let the producing wells be located near the center. Let N injection wells be uniformly spaced on the water contact for the breakthrough bed. The area to be invaded per injection well is proportional to the central angle which is 360/N degrees. The fraction of the area within a 360/N degree sector which is invaded at breakthrough is defined[1] by

$$I = \frac{N}{N+2} \qquad (13)$$

where I is the breakthrough invasion factor for the breakthrough bed at the time water appears in production for a particular sector. If there be ten uniformly spaced wells on a circular water contact, the breakthrough invasion factor is 80 percent of the per-sector area.

Now consider alternate rows of producing and injection wells. Let the distance between wells on an injection row be "a" feet and between wells on a producing row, p feet. Let the distance between injection and producing rows be d feet. The area of a rectangle having sides d and average end $(a+p)/2$ is $d(a+p)/2$. This is the area to be invaded. The breakthrough invasion factor for a rectangular area is defined[2] by

$$I = \frac{N^2}{N+2}\left[\sin\frac{360}{N}\right]\left[\frac{ad}{3.14(a+p)d}\right] \qquad (14)$$

where N is the equivalent number of wells given by

$$N = \frac{180}{\sin^{-1}\left[\ 4\left(\frac{d}{a}\right)^2+1\ \right]^{-1/2}} \qquad (15)$$

Figure 8-4 is a solution of equation (15) for distance between wells on a producing row equal to the distance between wells on an injection row. The $p=a$ curve in Figure 8-5 is a solution of equation (14) for equal distances between wells on injection and producing rows. The invasion factor is expressed in percent of the area (ad). When a B contour breaks through into a producing well for $d/a = d/p = 2$, about 83 percent of the acres within (ad) are between the B contour and an injection well. The other 17 percent of the acres within (ad) is not invaded by water.

The $p=O$ curve in Figure 8-5 shows the invasion factor for centrally-located producing wells within an injection circle. When the distance between wells on a producing row is less than on an injection row, $p<a$. The invasion factor for $p<a$ is some value between the two limiting cases. The difference between the two curves is less than two percent for d/a greater than three.

The foregoing considerations are on a per-sector or per-rectangle basis for a breakthrough bed. But the production from a well may be by virtue of water injection into several wells. The location of wells fixes the number of per-reservoir producing units and the number of injections wells displacing fluids in the direction of a particular producing well.

One Producing Unit

Figure 8-6 illustrates one producing unit for a radial reservoir. There are 24 producing wells located on the crest of the structure. Eighteen injection wells are located along the original oil-water contact. When a sufficient volume of water is injected, the oil-water interface will have advanced to a position indicated by the B contour. The section of maximum recovery will have advanced to a position represented by the M contour. The B-M region contains oil which is displaceable by water. All the displaceable oil from the acre-feet of pay between the M contour and the original water contact has been forced updip. Some of the oil displaced from the downdip side of the B contour was retained within the acre-feet on the updip side of B. The retained oil displaced gas. The difference between the displaced and retained oil was recovered without producing any water.

Figure 8-7 is a N-S section through the center of the radial reservoir shown in Figure 8-6. When the B contour advances high enough updip, water will break through into the structurally-lowest producing wells. Breakthrough is via one of the lower beds unless some upper bed has a disproportional rate of depletion. The problem is to estimate (1) the position of M for any position of B, (2) the oil displaced from the acre-feet of pay below M, (3) the oil displaced from the B-M region and (4) the cumulative oil recovery for any elevation of B prior to breakthrough of water into producing wells. Item (4) is the difference between the oil displaced from below B and the oil retained by the acre-feet of pay above B.

Oil reservoirs contain free gas at pressures less than saturation pressure. Free gas is displaced ahead of oil. The quantity of oil retained, filtered out, by the acre-feet of pay not invaded by water varies with certain factors to be considered in the next article.

REFERENCES

[1] Jones, P. J., "Petroleum Production," Vol. I, Reinhold Publishing Corp., New York, 1946.
[2] Ibid., Vol. IV.
[3] Ibid., Vol. III.

Primary Factors in Reservoir Engineering

■ CONTINUED FROM PAGE 168

voir is the primary controlling factor, however, since there is no reason why a high viscosity crude could not be displaced providing a uniform permeability distribution existed.

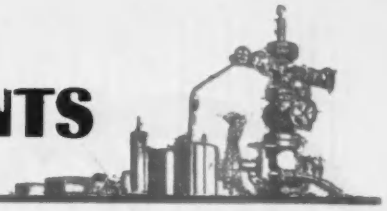
Retrograde reservoirs are amenable to so-called recycling operations in which the condensate and the less volatile components are removed and blended into a marketable product and the dry, or residue gas, is injected into the reservoir to pick up more volatile components. This practice, under prudent management, eliminates condensation to a large extent in the reservoir, which is the main reason for such operations.

To determine the economics of a reservoir engineering study the engineer must calculate rates of depletion under different development plans. The most powerful tool in this instance is the material balance equation or the appropriate application of the law of conservation of mass. With proper data the engineer is able to calculate depletion curves for primary and secondary mechanism. The pressure and production history can be forecast for a given percentage decline or for a given rate of injection and production. Unfortunately, the engineer seldom has all data requisite for such a study but certain reasonable approximations enable him to obtain values to temper his judgment. If all of the facts required for a complete solution of the material balance equation were known, there would be no occasion to use it. The absence of one or two variables makes the equation useful.

Similarly, well spacing is reduced in its final analysis to economic considerations, since all the objective evidence to date indicates that recovery is independent of spacing if economic factors can be disregarded. Such a statement gives occasion for discontent from owners of mineral interests who are justifiably interested in returns within their generation and to whom more wells mean more income earlier. Close spacing orders give rise to discontent from operators and companies who pay for the increased costs attendant with closer spacing. There is probably no such thing as an optimum spacing program since the entire matter is closely geared to economic factors such as the price of oil, materials, labor, etc., and the conflicting interests. The reservoir engineer can predict recoveries at rates of depletion based on economic data or assumptions from management or clientele and arrive at the proper spacing and development program based on these assumptions. These considerations apply to primary and secondary methods alike.

How to do it!

PRODUCTION HINTS



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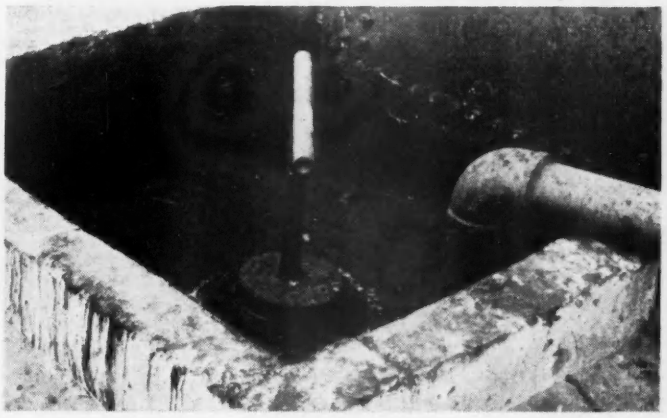
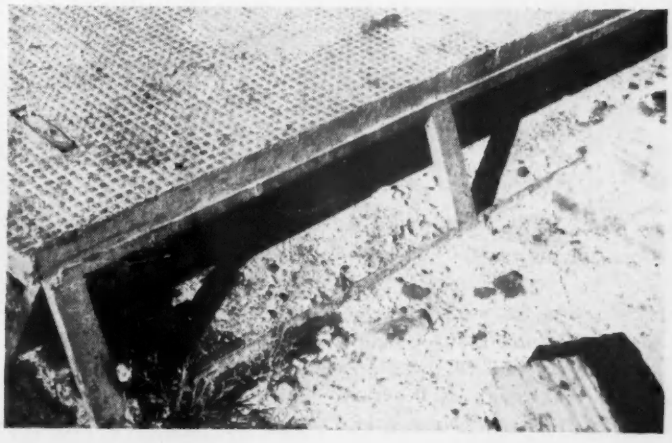
HOW TO—Install Cleanout Sump Drain



If a rectangular concrete sump is to be included in the equipment supporting to, and as an auxiliary of, a battery of tanks on a lease, the drain line can be installed so that tank bottoms and drained water can be flushed away with a minimum amount of time and effort. If more than one tank is in a row, the drain line can be a continuous one laid under ground but on a running ell with the side opening directed up toward the center of the sump. Into the ell, a nipple of the desired length is inserted to support a pipe coupling, or collar so the upper rim of the collar will be slightly below the surface of the concrete floor of the sump.

A gentle slope of the floor surface from all sides toward the collar opening facilitates draining and will prevent heavy material from piling up away from the opening. A six-inch set is used so a threaded section of six-inch pipe can be used when a flat head is welded into one end. One-inch pipe with a tee handle is attached to this flat end plug so the opening in the drain can be closed to prevent foreign matter and debris from clogging the pipe, requiring a cleanout before the tank inspection plates are opened for reconditioning.

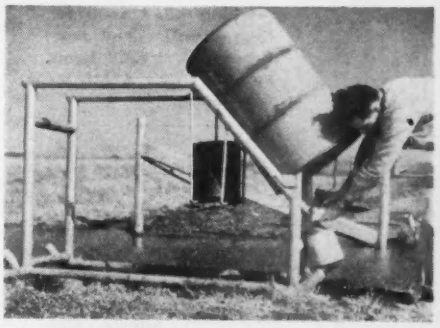
HOW TO—Support and Lock Walkways



For increased speed and convenience in assembling and disassembling steel walkways surrounding well service equipment or drilling rigs, good use can be made of a type of base which not only supports the walkway in a level position, but securely holds the adjoining sections together.

The base, of pyramidal cross section, and of sufficient length to support the full width of the walk, is made of light channel iron welded together. The top, or apex member, has the channel turned upward to provide a slot into which the ends of the adjoining walk sections can be placed. By using such a supporting device, much time is saved by men in rigging up, for time-consuming adjustments and levelling or matching of walkway sections with ordinary blocking thus is avoided.

HOW TO—Make Drum Rack



To make it easy for the pumper to get the last drop out of his chemical drum when viscous chemicals were used, one company designed the rack illustrated. Skid-mounted for easy moving between leases, the rack is built so that the drum will rest on parallel bars. A shelf was made for the five-gallon container to be supported under the spout. The front of the rack, however, is cut off on a 45 degree angle so that when the level in the drum is down to the opening, it may be pulled ahead on the inclining rails. A bucket may be placed under the large opening and the last drop efficiently drained from the drum. Where viscous liquids are handled in cold weather, the pumper may allow several minutes for the drum to effectively drain while the drum is lying on the inclining rack.

When the lease foreman sees the drum in the inverted position, he has the signal that another drum of chemical is needed, and a new drum is placed on the rack behind the empty one.

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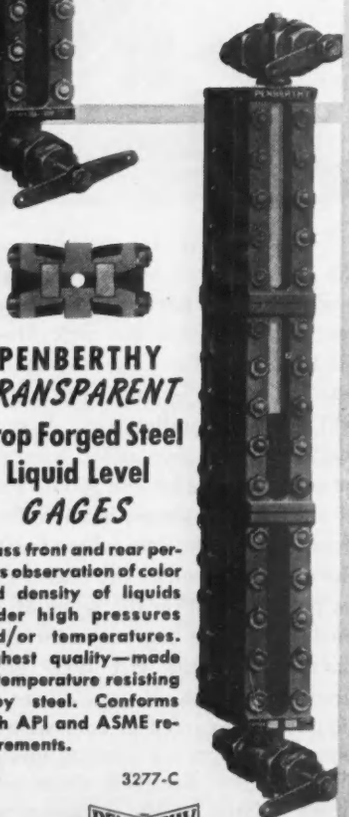

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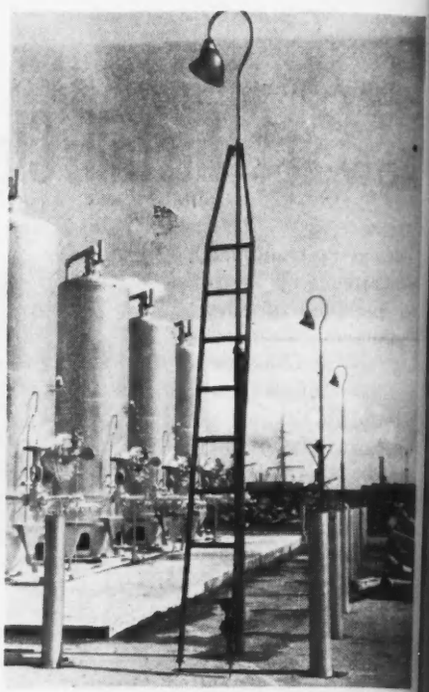
HOW TO—Fabricate Special Utility Ladder

Replacing burned out elements in flood lights is a job that requires a ladder which will not slide outward at the base when an employe, or the company electrician, climbs up to the goose-neck to remove the vapor-proof globe. The type of slip-proof ladder used by one producer at groups of separator batteries is made of one-inch tubing for the side pieces which are shaped above the top round so each side piece is bent to bring the top ends closely enough to each other to be welded to 1½-inch coupling which has been split lengthwise to fit against the goose-neck standard of the lamp post.



The rounds are welded to the side pieces at the separation distance desired so that eight of them will be sufficient for convenient climbing. The lower end of each side piece is fitted with a pointed steel pin, which extends about two inches outward from the side piece opening where it is welded to a circular plate about three inches in diameter to act as a foot-piece so the ladder will not sink unevenly in the ground. If the ladder is used on ordinary ground, the pins sink readily until the ladder is stopped by the circular plates. If, however, the ladder is used on black-top or upon a concrete apron, the hardened points readily point into the hard surface to prevent slipping, and will create a confidence by the workman in his ladder so he can change lamps without hesitation.

HOW TO—Build Portable Bailer Dump Box

In town lot and similar types of congested areas where it is not practicable nor advisable to have sumps beside each well to catch bailings and waste fluid, some type of portable waste tank must be brought to the well site whenever a well is bailed or cleaned. One such type of container used by a major company has been found to be of practical value, yet does not involve much time or material in its construction. The tank is five feet square, and is made up of square sections of salvaged tank siding material which are welded to a framework, including skid bases, of two-inch pipe. In one corner of the covered top, a hole was cut out to permit hanging inside the tank a short length of casing which serves as a bailer guide and dump device. Inasmuch as the tank is nearly all enclosed, very little splash or spray escapes when a bailer load is dumped. Lifting eyes welded to each of the top corners facilitates hoisting the tank aboard a truck for transporting from well to well.

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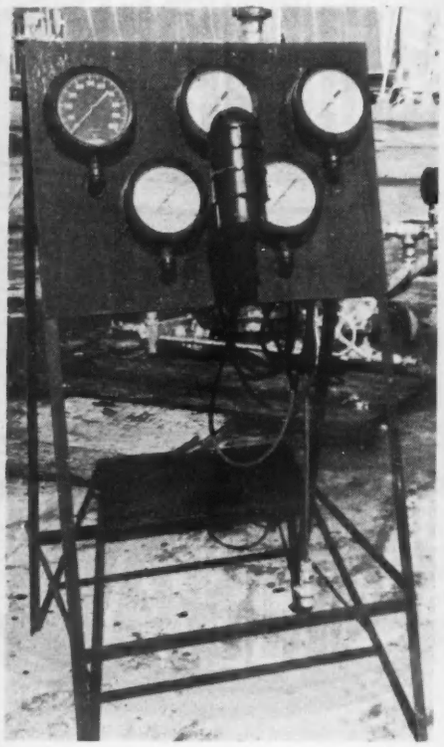
PRODUCTION HINTS

HOW TO—

Make Well Gauge Board



When making pressure tests of wells under varying conditions, as many as five different gauges may be required with individual hookups. To provide the facilities necessary for pressure tests using indicating instruments, the gauges can be grouped on a portable stand which can be carried from well to well in a pick-up. The frame for this easel-type mounting is made by using light-weight angle iron for the legs and light strap iron for girts and sway-braces.

The panel to which the gauges are attached is a rectangular sheet of light weight steel welded into the angle from iron legs with connecting straps for stiffness. The gauges are attached to the front of the panel with rim screws so that stress is removed from pipe fittings.

All connections to be made on various parts of the well lead into the back of the panel so the front is free of any obstruction. So that work can be carried on at night, the panel is supplied with a lighting fixture attached to the board with the cord leading from the back to the receptacle at the well for lights or power take-off. The lighting fixture has a shield with the opening arranged to direct the rays of the lamp to the gauges without glare being reflected back to the engineer or operator doing the work.

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SAND PUMPS
Standard Clean-out Tool for 25 Years

Check any oil field in the world where sediment or sand is met with and you'll find Miller Sand Pumps and Bailers are standard . . . leadership earned and held by continuous improvements during 25 years of service!

The Miller Sand Pump is made in Regular and Heavy Duty types in sizes listed below. Lug type Chisel, Sand and Bailer Bottoms are easily interchanged.

Threaded Chisel and Sand Bottoms can be supplied, to permit larger pieces of sediment to pass, and pump to be dumped without removing bottoms. Tool Pin bail allows tools and sand pump to be run on same wire line when desired.

Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue page 2666 for details.

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Outside Diameter
2½"
3"
3½"
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20 feet
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Versatile VALVE

LEFT: A six-inch 10,000 p.s.i. test Otis Type XAB Surface Safety Valve manufactured for use on a 6" high-pressure gas injection line.

RIGHT: A two-inch 5000 p.s.i. test Otis Type XBD Surface Safety Valve equipped with both high and low-pressure pilots to operate on low pressure differentials.

Dependable automatic flow line protection! That field-proven fact has firmly established the Otis Surface Safety Valve as a versatile piece of safety equipment adaptable to many different types of well, field, and plant installations.

You'll find these full-opening, pressure-operated, heavy-duty Valves on single and two-zone well connections, flow lines, transmission lines, gas injection lines, LPG systems, hot oil injection and return lines, etc., maintaining constant guard against dangerous pressure increases or drops — *and always ready to snap to a positive shut-off in the event a line breaks.*

Check the vulnerable points in *your* flow line systems. Then check the advantages of having this extra-added protection — *more dependable, more economical than personal supervision.*

Otis Surface Safety Valves consist of an Otis bonnet assembly and either a high-pressure or low-pressure spring-loaded pilot valve, or both, combined with a conventional heavy-duty gate valve body and gate. When line pressure increases or decreases beyond predetermined safety limits, either the high or low-pressure pilot snaps open, exhausts fluid or gas in the chamber beneath the piston to atmosphere, and automatically drives the gate valve down to a positive shut-off. Snap-action protection — the instant you need it!

Write Otis Pressure Control, Inc., Box 7206, Dallas, Texas, for complete details.

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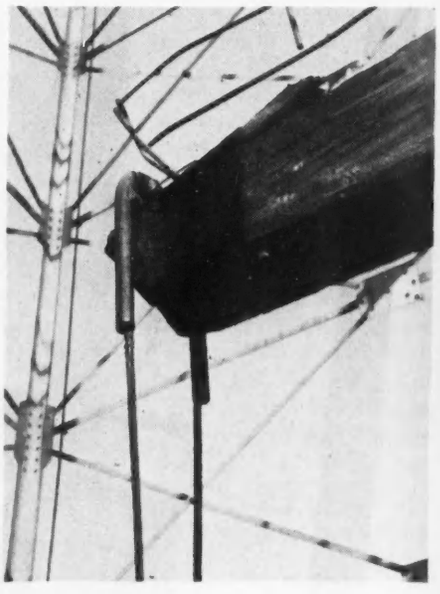
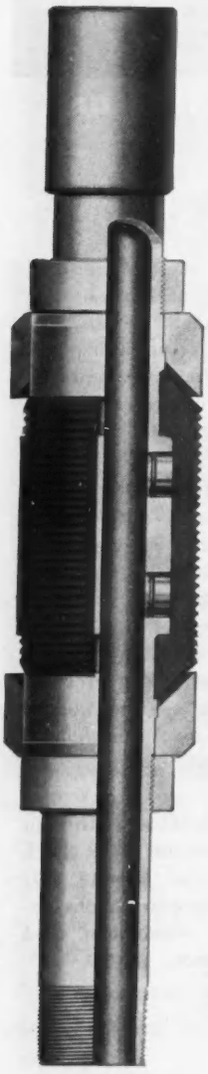
HOW TO—Mount Hanger on Walking Beam to Protect Wire Line

An improved type of wire line hanger suitable for use on wells still equipped with the wooden walking beam standard end units is employed by one operator. The hanger consists of a length of two-inch extra heavy pipe bent into a U-shape, the distance between the legs being governed by the thickness or width of the walking beam. Across the legs, and as close as possible to the point where the pipe begins its bend, is welded a short piece of similar pipe material. This horizontal member rests in the hanger bearing at the end of the beam.



Pictured, a single line may be run, through the hanger. The ability of the line to shift either way through the hanger permits even distribution of the well load. By providing legs of sufficient length that they project down from the the hanger bearing a foot or two, the line is guided through a greater distance and reduces possibility of chafing at the point where it emerges from the pipe hanger.



Type "B" Tubing Anchor

STOP TUBING TRAVEL with the PAGE Tubing Anchor

PAGE TENSION TOOLS

THE PAGE TYPE "B" Tubing Anchor gives you *six* advantages never before realized in conventional type anchors . . . they're possible because the Page Type "B" incorporates an entirely different operating principle—*it sets hydrostatically and holds hydraulically!*

The Page Type "B" Tubing Anchor permits . . . *(1)—assembly in the tubing string either end up (2)—fast run-in without danger of "accidentally" setting slips (3)—automatic setting without tubing manipulation (4)—setting at correct depths because slips set as fluid rises in tubing (5)—compensation for temperature changes (6)—easy release by simply draining tubing.*

The Type "B" Eliminates...

REVERSE TORQUE on tubing threads—main cause for high pressure leaks.

EXCESSIVE WEAR on casing, tubing and rods—common with compression anchors.

SUCKER ROD BREAKAGE caused by excessive tubing travel. The Page Type "B" Tubing Anchor keeps rod breakage at a minimum because it *smooths out* reversals in the pumping cycle.

Field records prove...

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store – find out how Page "Tension Type" Tools can help *you!*

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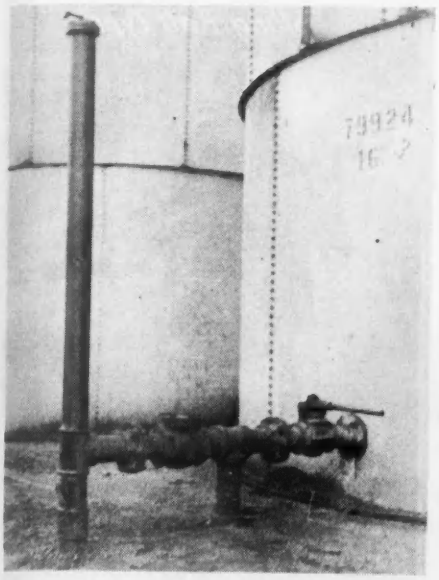
HOW TO—

Free Tank Lines of Air

When a tank is pumped out and there is no one present to turn it off, air is sucked into the line and may cause a gas lock in the pipe line pump. One method of overcoming this difficulty is to place a float in a riser above a tee into which all of the tanks in the battery are connected. The float is elliptical in shape so that it seats in the lower part of the tee when the level of the tank from which the oil is being pumped reaches the outlet connection. This effectively prevents air from entering the line.

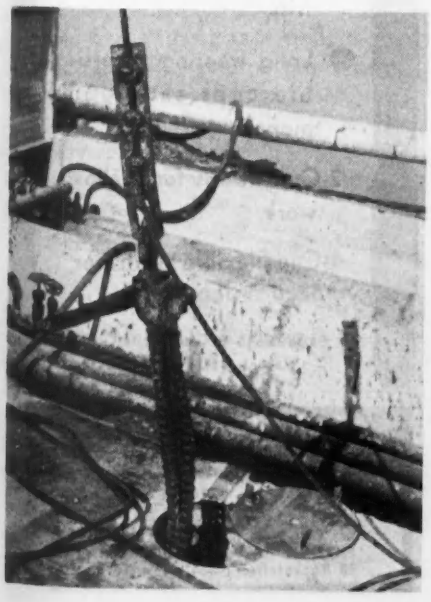
When the tank is shut off, the gauger trips a lever which automatically re-



leases the float so that it will rise in the pipe with the level of the liquid. In order to keep from making the riser as high as the tanks, a seat is fixed at the top of the float so that it seals off when on the rise. A quarter-inch connection is placed at the top of the riser to check whether or not the device is functioning properly.

HOW TO—
Secure Rig Guy Lines

An improved method of securing guy lines to the dead man post, and one that permits the line to be held tightly without resorting to loops or knots which would leave permanent kinks in the line, is employed by a well servicing company. A short length of one-fourth-inch steel plate, torch-cut to provide a loop into which the hook of a ratchet lever hoist can be inserted . . . and provided also with a series of three pairs of holes through which cable clips can be inserted . . . is made up for each anchor line. The guy line illustrated is laid along the steel strip and the cable clips then run through and tightened, clamping the line securely to the plate.



Principal advantage of this device is that when a pulling unit is set up at a number of different locations, each having deadmen anchors spaced at varying distances from the well, the connector can be loosened and repositioned at any point along the line. Tightening of the guy line, and taking up or letting out the several feet of adjustment that may be needed, is taken care of easily by the ratchet lever hoists, one of the latter being affixed to each guy line. A minimum of damage is done to the line when it is clamped in this manner, much more service thus being obtained from each line.

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McKissick Traveling Blocks are made to fill *every* need in the 50 to 250 Ton field.

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Cameron

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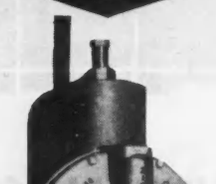

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- Instantly adjustable

The Cameron Non-Hydraulic Weight Indicator is so sensitive to small weight changes that the driller can quickly and easily read the load directly in pounds . . . not points . . . almost to the pound.

Because of its Non-Hydraulic mechanical movement, it is entirely free from troubles due to leakage of fluids or due to temperature changes.

Like the popular Cameron Pressure Gauge, the case of the Cameron Weight Indicator is oil-filled to provide a viscous dampening of the dial to eliminate the harmful effects of mechanical vibration.

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Cameron

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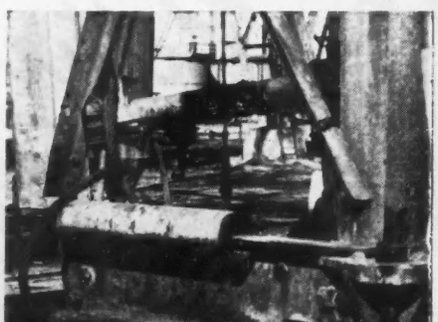
HOW TO—

Anchor Tubing Line

On producing wells equipped with steel derricks having a reinforced inverted "V" opening for a rig front walking beam, a section of the base at one leg can be converted into an anchor for the tubing line. This section is usually a short section of structural steel bolted both to the leg of the derrick, or its foot-piece, and to the diagonal brace forming part of the inverted "V" opening for the rig front walking beam. If the anchor end of the tubing line were

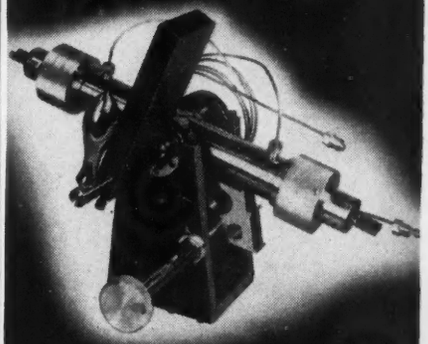


looped directly around this beam, the sharp edges would shortly fray or cut the cable causing it to fail under a load when the pulling machine starts out of the hole with a string of pipe. Removing the base and top of the beam would weaken it without supplying a rounded surface for the steel cable to grip when anchored.

To provide an adequately rounded surface to protect the steel cable, short sections of pipe are welded to both the base and top of the piece of structural steel. As the lower side carries the greater part of the load, a piece of large pipe is split and opened to fit into the beam on either side of the web, while a smaller split nipple is placed on the outside of the beam where the diagonal pull is made when the tubing line runs from this point to the crown block. Both pipe nipples are securely welded and burred to remove sharp projections which might damage the wire line or be a hazard to employes working at the well.

Improved Accuracy VISCOMETER

Rolling Ball Type



Ball rolls in precision bore insert tube. Accuracy improved with large ball. Range of sizes available gives flexibility of roll time. Operator's errors in timing eliminated by automatically operated clock. Can be used independently or as part of any PVT system.

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By

W. H. STUEVE,

Oklahoma City

THE use of electric motors as prime movers for pipe line stations in pumping crude or products increased greatly from 1925 to 1940, primarily because the pumping units were changing from the slow speed reciprocating plunger pump to the direct-connected and higher speed centrifugal pump. The power suppliers were also alert and with their knowledge gained in electric transmission, by gradually using higher and higher voltages and better equipment for service continuity, the availability of sufficient capacity for the remote pump station locations became a reality, and generally within the realm of economic justifications.

During the period immediately prior to and during World War II, a further increased usage of electric power for the oil transportation industry was noted, principally occasioned by the inability of the manufacturers of internal combustion engines to make deliveries, for their market was shifted to marine propulsion equipment and other wartime demands. After the war period, the experience of the oil transportation industry gained through the successful economic operation of the "Big Inch" pipe lines, which were completely electrified, gave a further impetus to this form of power.

At the present time, with most of the pipe line construction taking place in the Southwest where the bulk of electric power is generated with natural gas, the use of motors might be said to almost become imperative, in view of the present market price of oil if used as engine fuel. In some cases the cost of producing propelling energy with oil fuel taken from the line has reached a value of almost three-fourths the total delivered cost of the equivalent electric energy. In territories outside the Southwest states where electric production is achieved by means of coal, the advantage is not so great, but nevertheless imposing, for the reason that the customary "coal clause" used by the electric utilities will generally raise industrial power rates perhaps 25 percent with a corresponding increase of 100 percent in coal.

It is estimated that at this time the oil transportation industry has well over 300,000 horsepower of motors in use on their main trunk lines, the same representing almost 40 percent of the capacity used for this type of service. This figure was somewhat greater during the war when the "Big Inch" lines were in service of pumping oil and products, but now the main portion of these motors are being used to compress natural gas.

With this background of a gradual increase in the use of electric power and a general acceptance by the oil industry, consideration was given to collecting information concerning the actual amount of energy required in the operations of several totally electrified pipe lines, from which assembled data some predictions could be made of long term possible energy requirements when capacity or delivery changes become necessary.

Records of six of the principal electrified pipe lines were studied, and the annual deliveries in barrels along with annual quantities of electric energy purchased were noted. In some cases as many as seven years were covered in the study with great variations in capacity factor noted, from a low of 50 percent during some years up to full design capacity throughput for other years. Table I indicates the essential detail of the pipe lines studied with station design pressures approximating 800 pounds per square inch for the smaller 10- and 12-inch lines, and 750-720 psi for the 20- and 24-inch lines, respectively.

In reviewing the equipment types installed for the pumping stations shown in Table 1, it can be noted that the use of induction motors is predominant, also

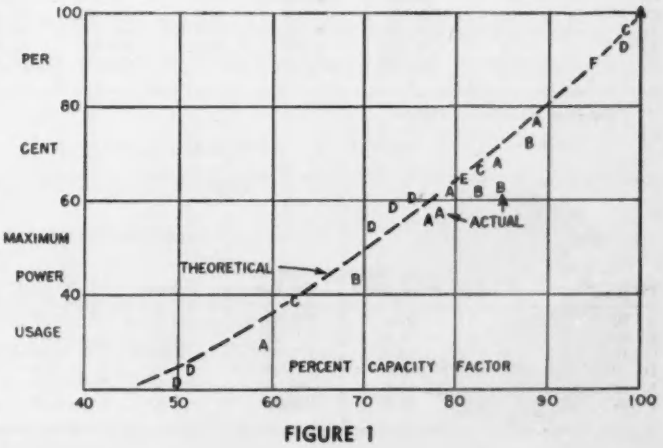

FIGURE 1

that this holds true for the use of centrifugal pumps. In two cases shown, Lines "B" and "D" where plunger pumps were installed, certain circumstances accounted for their selection. In the case of Line "B," the plunger pumps were installed because they were salvaged from an abandoned line. In the case of Line "D," the plunger pumps were selected because the oil or products to be handled had a great difference in viscosity and gravity; and since the line passed through territory subject to extreme low ground temperatures, this condition aggravated the pumping problems, especially when high viscosity oils had to be moved during the winter months. Also on Line "D" synchronous motors were installed, two 500 hp units in each station, which permitted the use of comparatively low ratio speed reduction gears, since the motors operated at 327 rpm. Sometimes the electric utility serving the pump station can deliver more satisfactory and more economic energy supply, provided unity power factor motors are installed. In general this becomes a matter of the "stiffness" (background capacity) of the supply system, and a matter of the proffered rate schedule wherein a bonus is sometimes given for attaining good power factor (90 to 100 percent).

The detailed operations for the six pipe lines shown in Table 1, indicating the actual energy used by all the pump stations, along with the actual deliveries in total barrels, are shown in Table 2.

In reviewing the results shown in Table 2, it can be noted that regardless of the size of the pipe line or the type of pumping equipment installed, there is a definite relation between the "capacity factor" when expressed as percent of the design maximum capacity, and "electric usage" when it is expressed as percent of design power required at such maximum capacity. This relation is "that the square of capacity factor equals electric usage."

Usage Factors

In the case of Line "D," which seems to depart somewhat from this general rule, and which is equipped with plunger pumps throughout, the apparent discrepancy between the actual and theoretical electric usage can be accounted for in that a wide variety of oils were handled during the time studied. This imposed greater or lesser working pressures than the original design contemplated, and therefore the required energy usage of the plunger pumps was reflected more readily in the results, than would have been obtained in cases where centrifugal pumps having a fixed pumping head were used. This also applied to Line "B" equipped with plunger pumps.

Since the yearly values of pumping and electric usage are available, from which the totals of Table 2 were derived, Figure 1 is shown with "capacity factor" for each year studied plotted against "electric usage" for corresponding years.

From Figure 1 it can be noted how closely each such annual value approaches the theoretical curve plotted by assuming that the electric usage expressed in percent of maximum design power requirement, will equal the annual capacity factor expressed as percent raised to the second power. The symbols shown in Figure 1 are used to distinguish each of the six pipe lines shown in Tables 1 and 2.

This study reveals that economic usage of electric power can be obtained by multi-station pipe lines, and that the annual averages for each year closely agree with the consolidated averages obtained for the period studied. It also lends considerable weight to the general observation expressed above, which shows that power usage falls off rapidly when decreased capacities are desired.

Some other interesting information can be gleaned from the almost 23 years operating records of these six electrified pipe lines from the assembled data in Table 3, showing energy required per barrel per 100 miles, and velocities attained under average pumping conditions.

From Table 3 it can be noted that the kilowatt hours per barrel required to pump the oil or products from station to station does not seem to vary a great deal regardless of the distance pumped, yet the lowest values are attained at the lower average velocities, as shown for lines "B" and "D." Again, in terms of kwh per barrel per 100 miles, the lower values are obtained in the case of Lines B and D (omitting the larger lines E and F) which use plunger pumps. The average capacity factors were about the same for the ten-inch Line "B" and 12-inch Line "D," but the pumping equipment consisted of plunger pumps, which would show perhaps 15 points better efficiency than centrifugal pumps of similar capacity.

Past studies have indicated that the most economic velocity of design falls between three and four feet per second, and this seems to be borne out from the data assembled in Table 3.

These past studies also indicated that if the contemplated velocity greatly exceeded 4 feet per second, and it was felt that high capacity factors would be achieved during the life of the pipe line, then the next diameter pipe of commercial size should be installed to reach optimum economies.

TABLE 1
Description of Totally Electrified Pipe Lines Studied

PIPE LINE	Data Years	Number of Stations	Type of Pumps	MOTORS		Design Capability Bbls./Day	Nominal Station H.P.	Length Miles	Pipe Diam. Inches
				Type	RPM				
A.....	7	4	Centrifugal	Induction	1800*	40,000	800	130	10
B.....	4	3	Plunger	Induction	600	36,000	600	191	10
C.....	3	14	Centrifugal	Induction	3600	95,000	1800	455	12
D.....	5.75	6	Plunger	Syn.	327	60,000	1000	168	12
E.....	1.5	29	Centrifugal	Induction	3600	235,000	3750	1454	20
F.....	1.66	26	Centrifugal	Induction	1800	330,000	4500	1254	24

* Changed to 3600 rpm after assembly of data.

TABLE 2
Actual Deliveries (Bbls.) and Energy Consumed (KWH) for Six Electrified Pipe Lines
(Reference Table 1)

PIPE LINE	Data Years	Maximum Possible Through-put 1,000 Bbls.	Actual Barrels Pumped 1,000 Bbls.	Average Percent Capacity Factor	Maximum Possible Energy Required 1,000 KWH	Actual Energy Consumed 1,000 KWH	Average Percent Electric Usage	
							Actual	Theoretical
A.....	7	102,200	81,439	79.5	147,168	91,763	62.1	63.4
*B.....	4	52,560	43,395	82.5	42,800	26,553	62.2	68.0
C.....	3	104,025	87,028	83.5	420,000	288,743	68.8	69.7
*D.....	5.75	126,000	92,387	73.2	181,000	103,696	57.5	53.6
E.....	1.5	128,700	105,960	82.0	1,130,040	751,946	66.5	67.2
F.....	1.66	200,640	191,197	95.2	1,365,811	1,276,458	93.3	90.7

* Equipped with Plunger Pumps.

TABLE 3

PIPE LINE	Average Station Spacing, Miles	Average Barrel Per Day	VELOCITY FEET/SECOND		ACTUAL MEASURED ELECTRIC ENERGY PER BARREL	
			Design	Average Attained	KWH/Station	KWH/100 Miles
A 10".....	32.4	31,800	4.80	3.80	.282	.870
B 10".....	63.5	27,600	4.32	3.30	.204	.320
C 12".....	32.5	76,600	7.40	6.30	.235	.725
D 12".....	28.0	44,000	5.03	3.70	.173	.616
E 20".....	50.2	193,500	7.55	6.12	.244	.485
F 24".....	48.2	315,000	7.35	6.96	.257	.532

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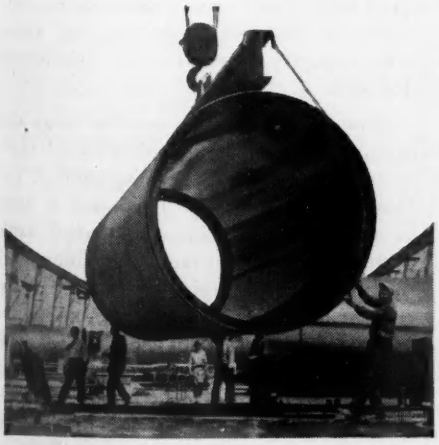

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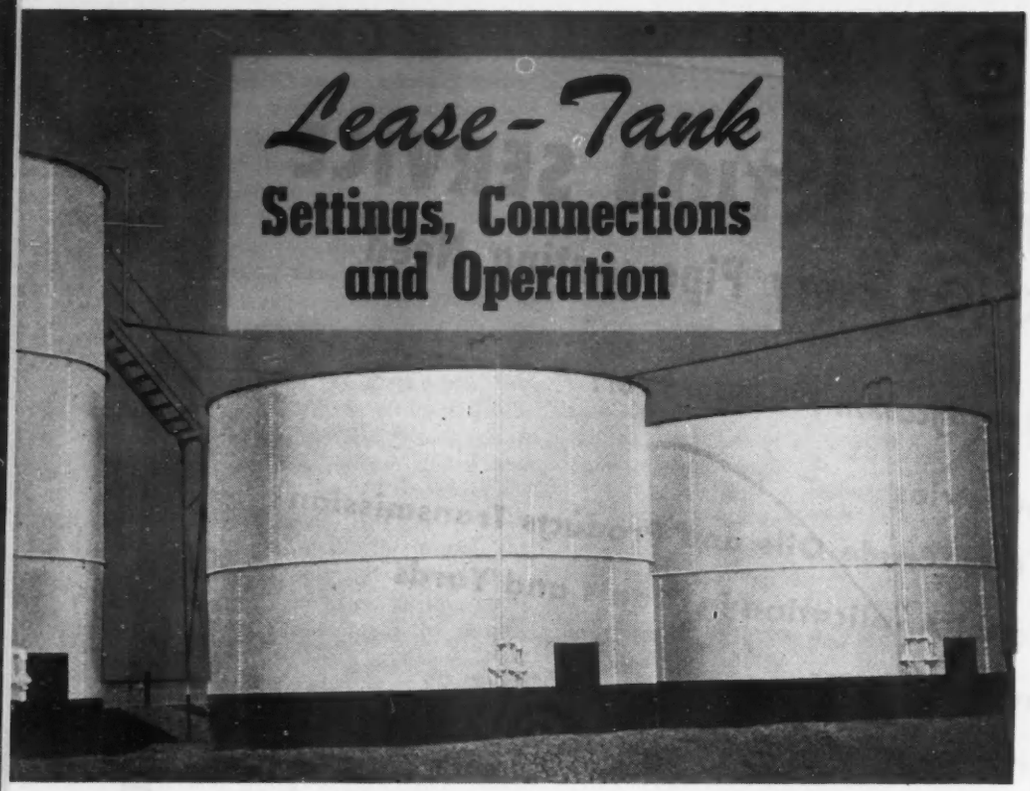


Lease-Tank Settings, Connections and Operation

INADEQUATE ATTENTION to details in use of lease tanks not only multiplies the work of the pipe line gauger, but entails other serious losses both to producer and transporter of the oil thus stored. The author, in a paper presented before the Division of Transportation Symposium on Pipe Lines, held in connection with the 1948 annual meeting of the API in Chicago, lists the more common shortcomings of lease-tank settings, and offers remedies for better operational facilities.

By J. C. STIRLING
Stanolind Pipe Line Company.

APPROXIMATELY 34,000 pipe line runs are made daily in the U. S., where the custody of oil passes from producers and royalty owners to the purchasers and transporters. Even though these transactions ring up oil sales totaling $15 million daily, there is probably less consideration given to the economics of lease-tank battery design, installation, and operation than to any other single item of the oil industry.

Because lease tanks and batteries frequently are improperly arranged and equipped to permit correct and safe handling of oil runs by the pipe line, the importance of a uniform program for setting, connecting, operating, and maintaining lease tanks cannot be over-emphasized. In the interest of both the producer and the pipe line, careful attention should be given to locating and equipping tanks so as to insure accurate handling of production and to protect the safety of pumpers, switchers, and gaugers who must work on and around the tanks under all sorts of conditions.

To go into detail on the matter of design, connection, and operation of lease tanks would to a great degree duplicate work that has already been done by various API committees. However, I wish to bring to attention some of the possible savings to both producing and transportation companies with the adoption of better standards and better practices.

Table 1 shows the difference in tank diameters as revealed by a survey compiled by company "A" of 511 tanks distributed throughout Oklahoma, Kansas, and Texas. The tanks were all steel, and were taken consecutively according to company numbers. No special effort was made to pick tanks of various diameters, and the table includes only a portion of diameters encountered for each nominal size.

Although some API committees have previously approved and submitted a tentative code, No. 12-D, for lease-tank fabrication, this code is not followed by tank manufacturers, who advise that tank sizes, as provided in Code 12-D, do not permit the use of standard size steel sheets as manufactured by steel mills and that, to follow the code, would result in considerable wastage. It appears, therefore, that consideration should be given to changing sizes of tanks to permit use of standard size sheets, thus reducing loss to a minimum.

No record was made of distances between tanks; however, the variances were comparable to variances in the diameters of the tanks. The importance of standardization of the center distance for the setting of lease tanks should not be overlooked either by the lease operator or transporter. Standard center distances will permit the prefabrication, installation, or reuse of tank headers furnished by the pipe line company.

TABLE 1

Nominal Tank Size (Barrels)	Number of Different Diameters	Range of Diameters (Feet)
100	41	7.89 to 10.06
150	11	9.43 to 10.02
200	33	9.24 to 12.07
250	24	11.98 to 15.42
300	8	10.79 to 15.24
500	27	14.76 to 21.59

As an example of the need for better standards in lease-tank operation, company "B" made a survey of unsatisfactory conditions in tank batteries in the Mid-Continent, West Texas, New Mexico, and East Texas areas, and found the unsatisfactory conditions indicated in Table 2.

In the selection of tanks for lease batteries, most operators are inclined to specify several small tanks rather than fewer tanks of larger capacity. Production men advise that this practice is to permit removal of a portion of a tank battery for use elsewhere after the production has declined to the extent that all tankage is not needed. The economics of larger tanks vs. smaller tanks, 250-barrel to 1000-barrel, having the same total capacity per battery, is shown in Table 3.

From these figures, we find that the initial cost of one high 500-barrel tank is approximately 75 percent of that for two 250-barrel tanks. The same is true in comparing a high 1000-barrel tank with two 500-barrel tanks. The increased installation and piping cost brings the cost of the initial installation up to an estimated 50 percent greater for the small tanks than for the larger tanks; thus the economics of removing a portion of the tanks after the production has declined has been largely offset in the initial installation cost.

Other reasons for the use of fewer tanks of larger capacity in a battery, in

addition to lower initial cost of installation:

1. Less evaporation losses to both producing and pipe line companies resulting from less surface exposed to atmosphere and less time required for oil to gravitate from the tanks.

2. Lower connection cost on the part of the pipe line company, serving the lease, as both labor and critical materials are saved in connecting fewer and larger tanks.

3. Less gauging expense, as the same amount of time is required to gauge and test the oil in a small tank as in a larger tank.

4. Improved operation of gathering systems resulting from the use of higher tanks, increasing the rate of gravitation from the tanks into the pipe line.

Overflow Lines

The use of overflow lines is not recommended, due to the possibility of losses and inaccuracies; however, if used, they should be equipped with lock stopcocks or plug valves with sealing devices, placed where they can be sealed closed while tank is on the line or in custody of a pipe line company. These lines, unless they are so equipped, are conducive to operations which can result in losses that may work to the detriment of either the producing or the pipe line company, depending on the conditions involved. Oral reports, which have not been confirmed, indicate that losses as much as 7000 barrels of crude per year have resulted in one district where equalizer lines were not equipped with lock stops. Appreciable losses to the pipe line companies have also been known to result from the use of these overflow connections, particularly where crude backs up into low batteries, causing a tank on the line to overflow into other tanks in the battery not then in custody of the pipe line company. Losses of oil suffered by the pipe line company have also been known to result from expansion of crude due to sun temperature where tanks have been gauged and placed on the line early in the day and held back due to higher tanks going out first. This expansion, due to increased temperature as a result of delayed exhaustion of the tank, results in crude overflowing into producers' tanks through the overflow lines unless equipped with valves and unless they are closed.

TABLE 2

Items Needed or Requiring Attention	AREA			
	Mid Continent	West Texas-New Mexico	East Texas	Total
Darts on stops	3	9	..	12
Bonnets on gas roller valves	7	17	..	24
Leaking pipe line stop	3	8	..	11
Sample cocks on tank	10	22	1	33
Wooden plugs in shell	28	6	1	35
Seams or lower chime leak	5	23	..	28
Hoops need driving wood	..	5	..	5
Visible drain on bleeder line	11	87	6	104
Visible drain inside fire wall	3	29	4	36
Visible drain covered	6	27	55	88
Stop leak on bleeder stop	6	24	..	30
	82	257	67	406
Safety				
Clean up inside fire wall	17	74	7	98
Provide walkway to gauge hatch	66	9	68	143
Repair walkway	3	16	22	41
	86	99	97	282
Gauging Practices				
Locate gauge hatch over pipe line connection	63	11	83	157
Filling and bleeder connection next to pipe line connection	364	311	124	799
	427	322	207	956
Total number of items	595	678	371	1644
Number of lease batteries	391	446	162	999

About the Author

J. C. STIRLING, engineer, Stanolind Pipe Line Company, Tulsa, is a native Texan, attended the University of Texas, and has been with Stanolind for approximately 20 years. He has had varied experience in both construction and operating phases of the work. He is a charter member of the National Association of Corrosion Engineers and is an authority on corrosion problems as affecting trunk pipe line operation handling all types of crudes.

Following are other suggestions for uniform lease-tank batteries:

1. Tanks should be set on a grade sufficiently solid to prevent appreciable settling. Tanks appreciably out of level should be leveled before pipe line connection is made.

2. Dents in tanks should be rounded out before pipe line or flow line connections are made.

3. Tanks should be set with pipe line connection openings aligned perfectly.

4. Steps and walkways should be properly constructed, safe, and equipped with at least one guard rail.

5. All tanks of nominal capacity in excess of 100 barrels to be equipped with two gauge hatches; the No. 1 hatch to be directly over the pipe line connection for all tanks; the No. 2 hatch (for tanks with nominal capacity in excess of 100 barrels) to be located diametrically opposite the No. 1 hatch. The center of the gauge hatches should be at least 12 inches from the shell of the tanks and placed so that no obstruction on the tank bottom shall interfere with the accuracy of gauges made through the hatches.

6. The pipe line connection should be located directly under the No. 1 gauge hatch, with the bottom of the outlet at least 12 inches above the tank bottom, for tanks having flat bottoms; or above the gauge plate for tanks with cone bottoms.

7. Drawoff connections should be located on or near tank bottom diametrically opposite the No. 1 gauge hatch; all drawoff connections to be equipped with lock stops or plug valves with sealing devices.

8. Flow lines to be located on the front of tank, away from the No. 1 gauge hatch, but where the flow line valves may be operated from the walkway; possibly the flume pipe (perforated in the vapor space) should be standardized, which would direct the flow to the center of the tank; all flow lines extending below the oil height of tank to be perforated in the vapor space above the oil height; flow line drop to each tank to be provided with stop or valve.

9. All vent lines to be provided with lock stop or plug valve with sealing device on the drop to each tank, and should be so placed that the vent line can be sealed closed while the tank is on line.

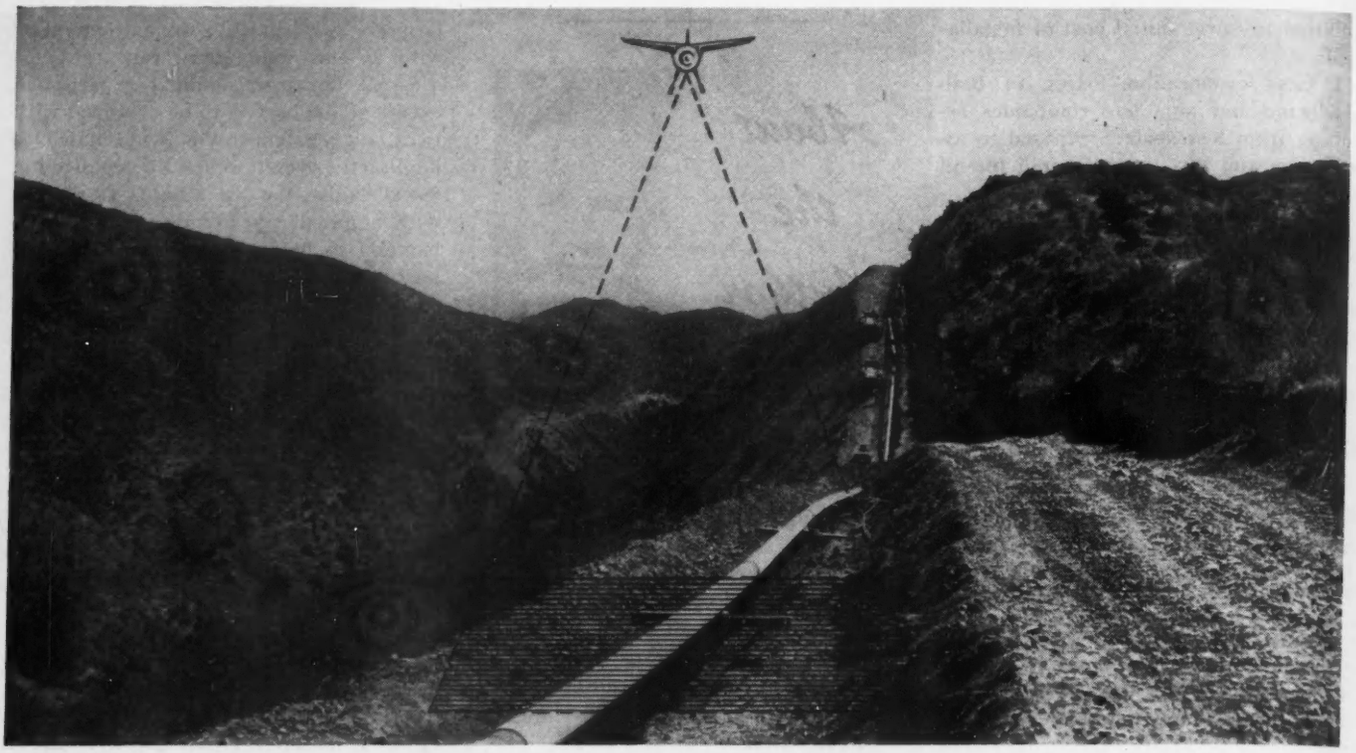
There is a definite need for cooperation between lease operators and pipe line companies in the selection of the best sites for tank batteries. From the standpoint of economy and conservation of materials, location of tanks can result in unwise spending and waste of materials, or in substantial savings to both parties concerned. In some cases, tank batteries have been erected in a low place place where the gravitation of oil by pipe line was impossible, whereas a little study by the representatives of the two companies would probably have resulted in a tank site being selected at a strategic point beneficial to both the lease operator and the pipe line. Operation and maintenance costs are reduced when gravity systems can be constructed, and better services can be rendered by gauger running oil if pumping can be eliminated.

Adequate storage and treating facili-

■ CONTINUED ON PAGE 202

TABLE 3

Size (Barrels)	Cost to Erect 2 Low Tanks	Size (Barrels)	Cost to Erect 1 High Tank
100	$ 840	200	$ 600
250	1,536	500	1,176
500	2,568	1,000	1,860



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Pipe Line Corrosion By Sour Crudes

By LYLE R. SHEPPARD
Senior Chemist, Shell Pipe Line Corporation, Houston

SOUR CRUDE causes serious corrosion in pipe lines and adds greatly to maintenance problems. The author, in a paper originally presented before a Division of Transportation Pipe Line Symposium at the annual meeting of the API, treats of causes, mechanisms and detection of corrosion. Metal permeability to hydrogen is briefly discussed and mitigation of this type of corrosion by oxygen, brine and hydrogen-sulfide elimination as well as by metal pacification is considered, in addition to types of preclusive design and operating practices.

PIPE LINE corrosion caused by "sour crude," i.e., crude oil containing hydrogen sulfide, is as variable as the weather; or as Mark Twain said: "We have it, but nothing much is done about it." In too many instances this type of corrosion has been tolerated because, like termite destruction of wood, when there is evidence of its existence the entire pipe line has become a mere shell, and replacement is necessary. Better methods of inspection must be developed, and ways must be devised of reducing sour crude oil corrosion.

Sour crude oil was produced from the Spindletop field in southeastern Texas during 1901, and new discoveries have increased the volume until it now constitutes a large proportion of the entire production in the U. S. The principal sources are in West Texas, New Mexico, Wyoming, Kansas, Arkansas, and some parts of Illinois. Its production, transportation, and storage have created major corrosion problems for the petroleum industry.

In this paper no attempt will be made to go into the technical details of this problem and its solution but rather to give a few of the practical aspects.

There are four main mechanisms by which hydrogen sulfide from sour crude oil attacks steel pipe lines:

1. Direct chemical combination of hydrogen sulfide with iron.
2. Oxidation of hydrogen sulfide to free sulfur, followed by chemical combination of sulfur with iron.
3. Iron sulfides from the two foregoing mechanisms form galvanic cells with iron in the presence of brine.
4. Creation of hydrogen-sulfide concentration cells which accelerate the sulfide or sulfur combination with iron.

In all four mechanisms hydrogen is liberated during the formation of iron compounds.

The combination of hydrogen sulfide with iron under ordinary pipe line conditions is a fairly slow reaction, and seems to be self-stifling. This type of corrosion usually results in the formation of a porous iron-sulfide film on the metal surface, with only occasional pits. This film, even though porous, has a tendency to slow down the iron loss. Laboratory tests show that the average iron-penetration rate is about 13 mils per year. The main importance of this reaction is the formation of iron sulfide which becomes saturated with brine or other electrically conductive solutions to form galvanic cells with the iron.

The oxidation of hydrogen sulfide to free sulfur, and its subsequent combination with iron, is important. Oxygen may combine with hydrogen sulfide to form water and free sulfur. Under certain conditions in pipe lines, free sulfur can also be liberated from hydrogen sulfide by solutions of iron salts, particularly chlorides. This is important, in that oxygen is not always necessary for the formation of free sulfur. Free sulfur, even in distilled water, is very corrosive to iron. In oil well brine it has an average iron-penetration rate of 1200 mils per year. This attack is almost uniform, with very few pits.

Galvanic cells formed between iron sulfide and iron are perhaps the most destructive mechanisms in reducing the service life of pipe. This is due to the deep pitting caused by them. Various iron sulfides are cathodic to iron, ranging from ferrous sulfide (with a negative potential to iron of 50 millivolts) up to a negative potential of 850 millivolts for iron disulfide. (These potential differences have been measured by various investigators, with almost identical results.) Iron sulfide forms on the metal surface. This metal surface beneath, covered with brine, corrodes to form more iron sulfide, so that the result is similar to an auger boring through the iron.

Hydrogen-sulfide concentration cells can be, and probably are, formed in pipe lines handling sour crude oil. In most cases where sour crude oil and brine contact each other more hydrogen sulfide is entrained in the oil than is soluble in the brine. This means that there is more hydrogen sulfide at the oil-brine interface than elsewhere in the brine. Inasmuch as an aqueous solution of hydrogen sulfide is acid, a concentration cell on iron surfaces is established with the anode, or corroding part, at the point of lesser acid concentration. This is another factor which accounts for the more severe attack along the inside bottom of iron pipe and which graduates to very little attack at the oil-brine interface. With metals more noble than hydrogen, such as copper, the anode will be at the point of greater acid concentration. This mechanism has only recently been postulated, and there has not been sufficient research to determine the average iron-penetration rate.

Detecting Sulfide Corrosion

To be on the safe side, it should be assumed that corrosion is taking place in any sour crude-oil pipe line until otherwise proved. Because corrosion occurs inside the pipe, only five means are available at present for determining corrosion existence:

1. Measurement of the wall thickness from the outside.
2. Insertion of test coupons into the pipe line.
3. Analysis of oil and brine for corrosion products.
4. Visual inspection.
5. Leak records.

Pipe wall thickness has been measured from the outside by means of gamma-ray and supersonic wave reflection. The dispersion of pitting or severe attack along many miles of buried pipe precludes such methods of inspection because of the expense in obtaining detailed information. Improvements are required before their use will be practical along extensive lengths of pipe line. In special cases they are of value.

Test coupons are often inserted into pipe lines for corrosion detection and rate of attack. Valuable information has been obtained by this method. (It has been used successfully in mitigation of condensate-well corrosion.) However, too many cases have occurred when the coupon indicated only slight corrosion but the adjacent structure metal suffered severe corrosion. Conditions existing at the pipe surface are difficult to duplicate on a coupon. Test coupons are seldom dependable for detecting and estimating corrosion.

Analysis of the oil and brine for corrosion products, although sometimes difficult, is a method of detecting corrosion. The points of corrosion attack will not always be determinable by this method. Because the final iron corrosion products of sour crude-oil corrosion are insoluble, a determination of dissolved iron in the brine is of little value. Any noticeable increase of entrained hydrogen between two points would indicate corrosion between them. The presence of iron sulfides in pipe line sediment would definitely indicate sour crude oil corrosion. An increase in the alkalinity of the brine would, in most cases, also indicate corrosion, although not necessarily that due to sour crude oil.

If a study is made of known corroded sections along various pipe lines, it is often possible to select similar locations on other lines for inspection and detection of corrosion. Locations where stream velocity decreases, and where design or construction allows brine and scale to be trapped and accumulate, are preferable for inspection.

Study of internal corrosion leak records will determine points of most severe attack. This is comparable to locking the barn after the horse has been stolen; the damage has been done.

It can be seen that much is to be desired in the detection of sour crude oil corrosion in pipe lines. This is especially true, because some lines corrode rapidly when crude oil has a high hydrogen-sulfide content and others do not; some corrode when the brine content is high, and others do not. Carbon dioxide may also be a factor in sour crude corrosion. These variations appear to originate from undetected differences in the oil rather than in the metal.

Hydrogen Permeation Effects

It might be well to mention two other types of failures due indirectly to sour crude. The first of these is that caused by hydrogen permeation ("Permeation" appears more descriptive of observed results) and blistering. Inasmuch as nascent hydrogen is liberated in all types of hydrogen-sulfide corrosion, it is possible, and very probable, that some degree of permeation and blistering does take place. This is a very insidious type of destruction because there is little or no loss of iron, but rather a lessening of its strength. This destruction is difficult to combat with oxidizing agents, for they increase the free-sulfur corrosion rate.

The second type of failure due indirectly to sour crude is that caused by iron-sulfide penetration. Equipment may appear to be in good condition upon removal from sour crude service. It may fail when placed back in service after a few weeks' storage, and sometimes at less than original pressures. Apparently iron sulfide accumulates in the intergranular cleavages caused by nascent hydrogen. Atmospheric oxygen reacts with the iron sulfide—promoting segregation along the metal grain boundaries, thus weakening the metal. It is good practice to treat such equipment in order to inhibit corrosion or exclude oxygen immediately after removal from service.

Factors presently recognized as contributing to sour crude-oil corrosion:

1. The primary corrosion source is hydrogen sulfide produced with the oil.
2. Oxygen greatly accelerates the corrosion rate.
3. Little or no corrosion takes place except when brine is present.

Thus the elimination of any or all of these elements will decrease, or even stop, corrosion due to sour crude oil.

Hydrogen-Sulfide Elimination

Elimination of water from a sour crude system will remove the hydrogen sulfide dissolved in it. Further elimination of the hydrogen sulfide will necessitate extraction from the oil.

Walter Rogers found that hydrogen-sulfide content in oil as low as 0.1 percent by weight promoted rapid corrosion. He also found that neither natural nor forced weathering for a reasonable period would reduce the content below that causing allowable corrosion.

Neutralization by chemical treatment is probably the most certain method of hydrogen-sulfide elimination. Many chemical treatments have been tried, with varying success. Hydroxides, phosphates, silicates, and chromates (usually of sodium) have been tried in the petroleum industry. The gas industry has been able to use additional chemicals for treatment; i.e., iron oxide, copper chloride, sodium carbonate, sodium phenolate, thioarsenates, and amines.

Various zinc salts have also been used to convert the hydrogen sulfide to zinc sulfide. Zinc sulfide is one of the more stable sulfides, and has not been found corrosive to iron in laboratory tests. Powdered zinc (suggested by U. R. Evans) has also been tried, but experience is lacking to determine its effectiveness.

The addition of a small amount of a detergent often causes a faster and better reaction with chemical treatment. This is probably due to a reduction of water and oil-surface tensions which allow more intimate contact between the various chemicals and hydrogen sulfide.

Most well brines contain calcium and magnesium salts. These salts may precipitate the inhibiting chemicals and thus reduce the amount available to react with the hydrogen sulfide. Precipitates may accumulate, causing capacity reduction and maintenance problems. No treatment should make processing of the oil more difficult.

Oxygen Elimination

Elimination of atmospheric oxygen is not considered practical where oil trans-

About the Author

LYLE R. SHEPPARD was born in Parkersburg, W. Va., October 6, 1904. He graduated in commercial engineering at Carnegie Institute of Technology, and began pipe line construction work with Williams Bros., Inc., Tulsa, and Ford, Bacon & Davis, New York City. For 13 years he was engaged in pipe line corrosion mitigation work with Interstate Natural Gas Corporation, Monroe, La., leaving there in 1946 to assume duties as senior chemist with Shell Pipe Line Corporation, at the Houston laboratory, working principally with corrosion problems.

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portation systems are not designed for closed operation. Nevertheless, a study of operating practices on open systems will show where corrections may reduce corrosion losses due to oxygen admission. Vapor-tight gun barrels and battery tanks will help in its exclusion. Installation of automatic check valves on gathering lines at tank-battery connection will reduce corrosion by maintaining oil-filled lines.

Brine and Water Elimination

Any brine or water separated from the oil will decrease potential corrosion. Several methods have been suggested and tried.

GRAVITY SETTLING: Rogers of Gulf Oil Corporation found that water continued to settle out of West Texas crude in storage at the end of 600 days. The huge storage capacity necessary for complete dehydration by this method would be impractical even if successful. Sour crude, causing rapid deterioration of gathering lines, gave little downstream-line corrosion trouble after several days in storage.

CENTRIFUGE: Field installations to throw out water by centrifuging have not been made in the United States because the equipment and power considered necessary make the cost prohibitive. Nevertheless, W. C. R. Whalley of Iraq Petroleum Company reports that it is being done with oil transported in his firm's lines.

ABSORPTION: Certain clays will absorb water, but will simultaneously absorb oil. Reclaiming the oil and clay is expensive. Clays or similar materials treated with chemicals to cause water attraction and oil repulsion may offer possibilities.

PUMPING: Although water elimination from oil is difficult, certain methods of handling reduce corrosion. Rogers has further noted that water will not settle out when sufficient velocity is maintained in pipe lines. He has determined minimum pumping rates and velocities for various sized pipe, as follows:

Pipe Size (Inches)	MINIMUM PUMPING RATES		
	Barrels Per Hour	Barrels Per Day	Feet Per Second
6	530	12,700	4.20
8	717	17,200	3.30
10	1,000	24,000	2.80

In West Texas this pumping rate seems to be one of the controlling factors between lines that have corrosion and those that do not.

EMULSIFICATION: It has been suggested that free brine be emulsified with the oil, before pumping, to reduce pipe-line corrosion within tolerant limits. Corrosion would be more evenly distributed over the entire internal surface of the pipe, and would give a longer service life.

Emulsification with high-frequency vibrations and later de-emulsification have been suggested; however, the cost of such procedure is not known. Investigators at Harvard and Massachusetts Institute of Technology have experimented with the effects of supersonic waves on liquids, but to the writer's knowledge little has been done on oil-water mixtures.

The method used by dairies to homogenize milk possibly could be used with oil and water. The cost of equipment ($8000 per unit) and capacity (1500 gallons per hour) would be prohibitive, unless lower-cost equipment could be designed for oil and water.

Certain chemical additives that have the property of converting water into oil emulsions have been used to reduce corrosion. These seem most promising at present for emulsification.

Iron Surface Pacification

Some chemical treatments do not neutralize the hydrogen sulfide, but form a film on the metal surface which impedes corrosion. This type of treatment usually requires less chemicals. Quicker penetration over smaller areas may be experienced if a complete protective film is not formed. Less metal will be lost but service life will be shortened. Chromates and formaldehyde have given favorable results in some locations. Phosphates and silicates have this same film-forming property under certain conditions, but have given poor results in the presence of sour crude.

In condensate wells it has been found that oils with iron surface-wetting characteristics tend to lower corrosion. Sour crude oils have generally been found to be of the non-wetting type; therefore, it is probable that the addition of an agent for conversion of the oil to a wetting type would lower corrosion. Some very important work is being done along this line.

Preclusive Design and Construction

By anticipating corrosion occurrence, it is often possible to design and construct new pipe line systems or other structures to minimize corrosion. Supervision of design and construction should consider minimizing oxygen and brine content of the oil in any system, provide for removal of sediment and scale, and avoid dissimilar construction materials, or electrically insulate them from each other.

A few obvious improvements in design from the viewpoint of lowering corrosion are given hereinafter. Several others may be noted by studying any particular pipe-line system.

STRAINERS AND TRAPS: More brine and scale traps of efficient design and adequate capacity are desirable. Their continued efficiency depends upon systematic cleaning and maintenance.

A reduction of oil stream velocity before entry into a pumping station would settle out corrosion products, thus would lower corrosion of station equipment. If traps or strainers are not available, this could be accomplished by a few joints of larger diameter pipe equipped for removal of accumulated brine and scale.

SUCTION MANIFOLD: It has been noticed that the packing and plungers wear faster on pumps remote from suction manifold inlet. A more even wear on all pumps might be obtained by connecting the suction inlet at the manifold center.

COATED PIPE INTERIORS: Cement or plastic lined pipe will lengthen the life of steel pipe lines. It has the apparent disadvantages of higher cost, greater weights, difficulty with bends, concentrated corrosion at coating imperfections, particularly at joints, and possibly damage by scrapers.

MATERIALS: Asbestos-cement pipe has been used successfully for low-pressure pipe lines.

Aluminum pipe recently has been placed under test in field installations. It is possible that it will be successful in lowering corrosion losses if sulfide corrosion products from iron can be prevented from contacting the aluminum. Aluminum tank roofs have shown promise of having long life in sour crude service.

Operating Practices

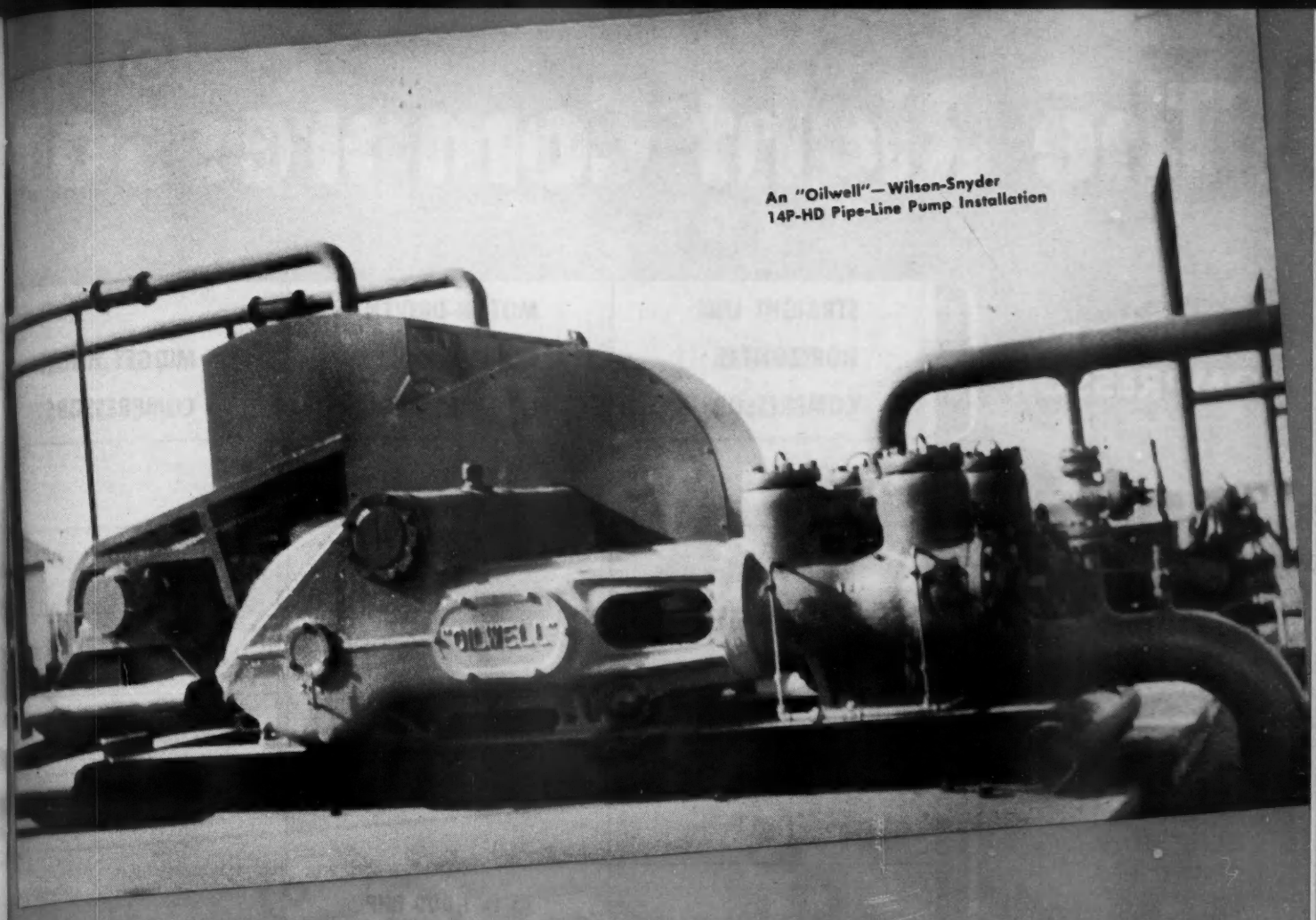
A very large amount of corrosion from sour crude oil can be stopped by slight changes in operating practices. In addition to the foregoing recommendations for the exclusion of oxygen and brine and the elimination of pipe-line sediment, the following practices are considered advantageous.

SCRAPER USE: A regular scraper program will extend the life of all lines which carry sour crude. The sediment has less chance to remain in one place to form increasing thickness of hard scale and entrap brine, thus accelerating the corrosion rate. Following is the leak record of a short section of line showing the effect of a scraper program. Note the extremely short life of this line handling West Texas sour crude.

Pipe Age (Years)	Original Pipe Leaks	First Replacement Leaks	Second Replacement Leaks	Third Replacement Leaks
1	1	0	4	0
2	8	7	6*	0
3½	89	175	48	(1½ Yrs.) ..
Totals	98	182	58	0

* Scraper program started.

Since the third replacement, chemical injection has been made, and may have



An "Oilwell"—Wilson-Snyder 14P-HD Pipe-Line Pump Installation

Long Life, Low Maintenance and Economical Performance...

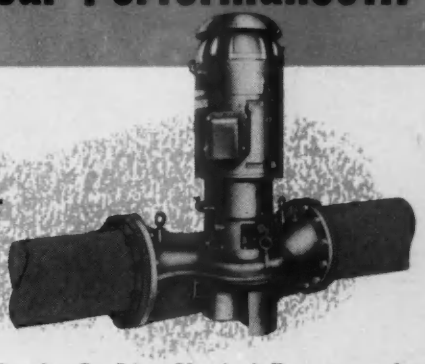
With "Oilwell" - Wilson-Snyder Pipe-Line Pumps

"Oilwell"-Wilson-Snyder pipe-line pumps are built to give continuous service day-after-day, in all kinds of weather. They are designed to perform outdoors as well as in stations.

The No. 14P-HD (7¼"x1 ') Duplex Pump, (illustrated above), is one of four placed in service by a major pipe-line company about one year ago. This same pipe-line company has other "Oilwell"-Wilson-Snyder pumps which have been in continuous use for many years.

Bring your pipe-line problems to "Oilwell" and let us assist you in selecting the equipment for your particular needs.

In Line Vertical Booster & Transfer Pump



The "Oilwell"-Wilson-Snyder In Line Vertical Booster and Transfer Pump is designed to, (1) accelerate the flow of liquids in existing pipe lines, (2) circulate hot or cold liquids and (3) be used for general transfer service. It is also widely used to boost the pressure in the suction lines at pumping installations where adverse suction conditions exist. This type of pump is available for capacities ranging from 400 to 4000 gallons per minute and pressures up to 160 feet, with suction and discharge flange sizes from 6" to 16".

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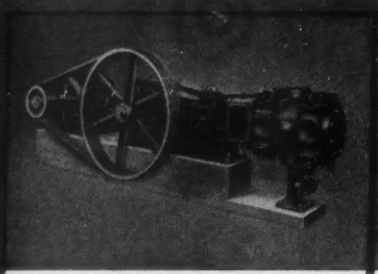
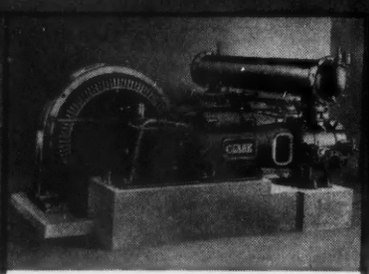
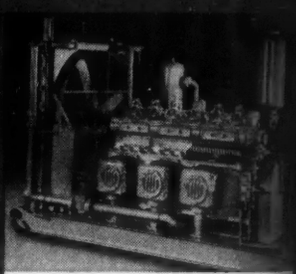
UNITED STATES STEEL

The Right Compressor f

TYPE OF COMPRESSOR	STRAIGHT LINE HORIZONTAL COMPRESSORS	MOTOR-DRIVEN HORIZONTAL COMPRESSORS	MIDGET ANGLE COMPRESSORS	RIGH COM
RANGE OF HP				
				200 to
			75 to 600 BHP	
		75 to 1,000 BHP		
	5 to 125 BHP			







CHOICE OF DRIVE					
Electric	5 to 125 BHP	Duplex	75 to 300 BHP	Gas Engine	75 to 330
Gas Engine	5 to 125 BHP	Balanced Opposed	150 to 1,000 BHP	Diesel	100 to 400
Steam	5 to 125 BHP			Electric	150 to 600
Gasoline	5 to 125 BHP				
Diesel	5 to 125 BHP				
Turbine	5 to 125 BHP				

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SETS THE PACE IN COMPRESSOR PROGRES

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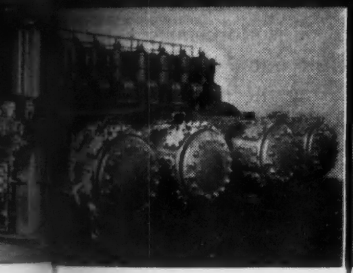
...r for the Job - by CLARK

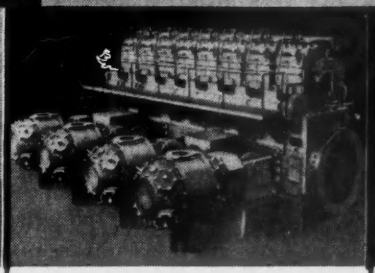
...GLE ...RS	RIGHT ANGLE COMPRESSORS	BIG ANGLE COMPRESSORS	CENTRIFUGAL COMPRESSORS	AXIAL FLOW COMPRESSORS
				To 30,000 BHP
			300 to 22,000 BHP	
		1,000 to 5,000 BHP		
	200 to 4,000 BHP			

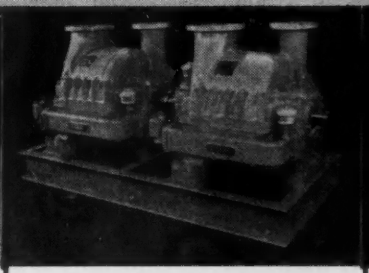
...BHP

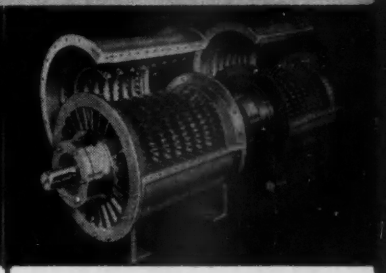
With the addition of the new Clark Axial Flow Compressor to the line, Clark now offers the most complete selection for any specific compressor application. Whatever your requirement may be—in capacity or type of service—we can furnish the right compressor, one that represents sound engineering and the finest precision manufacturing.

This chart indicates the over-all range of the Clark line of compressors. Space does not permit illustrating all types of drives, but you are invited to write for booklets containing detailed information. We have greatly expanded our manufacturing facilities in order to meet the increased demand for these products that are "setting the pace in compressor progress".









...330 ...Engine 200 to 880 BHP ...400 ...el 200 to 800 BHP ...600 ...m 450 to 4,000 BHP ...tric 400 to 2,000 BHP	Gas Engine 1,000 to 2,200 BHP Diesel 1,000 to 2,000 BHP Electric 1,500 to 5,000 BHP	Steam Turbine Electric Gas Turbine 1,500 BHP & UP	Steam Turbine Electric Gas Turbine 1,500 BHP & UP

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some effect on the leak record since that time.

GATE AND SUMP PIT DRAINAGE: It is common practice to pump accumulated oil and water from gate and sump pits into the system. Continuation of this practice may soon cause maintenance expense exceeding the construction cost of special equipment for water separation.

SWEET OIL BRINE: Brine from sweet-oil wells has a certain amount of soluble iron salts present due to contact with iron during production or storage. These soluble salts when added to sour crude oil cause precipitation of either iron sulfide or free sulfur, depending upon the solution acidity. Thus combination of sweet and sour crudes and their brines can become corrosive where neither was excessively corrosive alone. Because of this phenomenon, sweet and sour crude oils should be kept separated, and water should be minimized.

Summary

Inasmuch as sour crude now constitutes a large proportion of the entire production in the U. S., the detection and mitigation of internal pipe-line corrosion are very important to the petroleum industry in the reduction of maintenance expense and in the conservation of oil and metal.

Several means of corrosion detection have been used, but visual inspection and leak records still remain the most positive. Better detection and inspection methods are needed.

Sour crude corrosion is caused by hydrogen sulfide contained in the oil. Oxygen, brine, and sediment accelerate sulfide corrosion.

Any chemical treatment, or construction, design, or operating practice that reduces the hydrogen sulfide, oxygen, brine, or sediment will reduce sour crude-oil corrosion.

ACKNOWLEDGMENT

The author wishes to express his appreciation for the helpful criticisms of O. C. Mudd in preparing this paper.

REFERENCES

[1] Thomas S. Bacon and Elmer F. Schmidt. "Internal Corrosion of Natural-Gas Transmission Lines," *Natural Gas* **15** [12] 3-5, and 30 (1934).

[2] L. C. Case, "Corrosion of Oil-Well Equipment." *Pet. Engr.* **19** [3] 150 (1947).

[3] James A. Clay, Jr., "Use of Formaldehyde to Inhibit Corrosion," *Pet. Engr.* **18** [2] 111 (1946).

[4] George L. Crain, "Installation and Performance of Scale Traps in Sour Crude service," *Oil Gas J.* **47** [6] 92 (1948).

[5] U. R. Evans, *An Introduction to Metallic Corrosion,* Edward Arnold and Co., London (19).

[6] H. A. Gollman, "Chemistry of the Thylox Gas-Purification Process," *Ind. Eng. Chem.* **26** [2] 130-32 (1934).

[7] L. L. McWilliams, "Source and Purification of Gas Supply," *Oil Gas J.* **45** [28] 306 (1946).

[8] Walter F. Rogers, "Internal Corrosion of Sour Crude-Oil Pipe Lines Presents Serious Problems," *Oil Gas J.* **34** [23] 59 (1935).

[9] Lyle R. Sheppard, "Control of Internal Pipe-Line Corrosion," unpublished.

[10] Charles F. Turner, "Iron Oxide Vs. Liquid Treating for Purifying Natural Gas," *Oil Gas J.* **43** [20] 191 (1944).

Lease-Tank Settings, Connections and Operations

■ CONTINUED FROM PAGE 191

ties are also important factors of mutual interest to the lease operator and transporter. On many leases increased gauging service is required because of insufficient tankage, thus putting the pipe line company to additional gauging expense, involving also added expense to the producer in gauging and topping out his own tanks more frequently. The practice of treating oil in storage tanks due to lack of separate treating facilities frequently reduces the amount of net storage available. Adequate treating facilities would eliminate many refusals to run tanks of crude not meeting pipe line specifications. This, coupled with sufficient storage, will effect savings to both the operator and pipe line company.

Lease Battery Maintenance

Many companies continuously stress safety to their operating personnel, while tolerating poor housekeeping in and around the lease battery—thus contributting to the defeat of any progress along these lines. It is a responsibility of the lease operator to establish and maintain good housekeeping on and around the lease-tank battery at all times. The carrier's gauger should cooperate with the producer in his efforts to maintain this condition by avoiding unnecessary oil spillage and such bad practices as leaving dirty rags or broken seals lying around inside the fire wall. The frequently encountered practice of permitting water, oil, and water and sediment to accumulate around the tanks and inside the fire wall, to the point where it prohibits the proper inspection or operation of the connections and necessitates the pumpers or switchers and pipe line gauger to wade through this accumulation in order to perform their daily chores, has long been one of the sore spots of the men who must work around these tanks during all kinds of weather. Poor housekeeping constitutes a potential fire hazard at all times; and any accumulation of oil, unless properly protected from lease properties by adequate dikes (such as burn pits) may become ignited by lighting sparks from a distant fire or a carelessly dropped match or cigarette. Much more could be said on the danger of the switchers or the gauger slipping or falling on the walkway leading to, as well as around, the battery, or while working on the gauging platform, if the surfaces are not maintained free of oil, water, water and sediment. Adequate drainage away from the tanks, and proper disposal of water, and water and sediment to burn pits should be considered in the selection of the tank site, and should be continuously checked to see that proper drainage is maintained after the lease is actually in operation.

ACKNOWLEDGMENT

The author wishes to express thanks to R. C. Nicholson, Shell Pipe Line Company; J. B. Harshman, Stanolind Pipe Line Company; and Bert Martin, Stanolind Pipe Line Company, for their assistance in furnishing material for this paper.

Oil Pressure Research For Safer Pipe Lines

Research which will aid in strengthening oil transportation pipe lines to prevent recurrence of recent serious rupture damages is now under way at Northwestern University, Evanston, Ill.

Lewis H. Kessler, professor of sanitary engineering, and Merrill B. Gamet, associate professor of civil engineering, have perfected a test apparatus which makes it possible to determine accurately for the first time the bulk modulus of elasticity of any petroleum product. This value is then used in computing the speed of transmission of pressure waves and magnitude of the liquid hammer pressures.

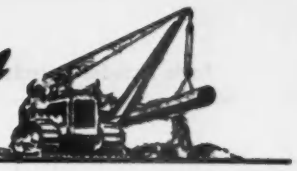
This information will help petroleum companies to determine the strength of pipe and amount of reinforcement necessary to prevent the liquid hammer pressure from rupturing the pipe line.

Magnitude of pressure wave also determines how slowly valves in the pipe lines must be closed so that pressure does not rise above a predetermined value based on strength of the pipe material, fittings and valves.

The research is expected to be of considerable importance to the oil industry, since no practical information on these values has ever been available before. The Northwestern engineers have completed test on McKamey, a South American crude, and on a mixed West Texas crude. They take a sample in a 300 cc. container and compress and then expand it. By measuring the volume of expansion, and the change in pressure, they arrive at the bulk modulus, after substitution in a simple equation.

Upon completion of the tests on various petroleum products, the researchers will study physical properties and behavior differences in fuel oils and gasoline.

PIPE LINE *Construction*



By CECIL SMITH
Staff Writer

FOR some time pipe line construction news was virtually monopolized by giant natural gas projects until plans for one of the country's largest crude oil lines were announced.

The Mid-Valley Pipeline Company, a newly formed concern, intends to lay a 1000-mile 22-inch line from East Texas to Lima, Ohio. The $56 million system will supply crude to Ohio refineries of Standard Oil Company (Ohio) and Sun Oil Company, organizers of the firm. Daily capacity of the carrier is to be 150,000 barrels to Cincinnati and 10,000 less at the Lima terminus.

Pipe Line Construction

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Atlantic Pipe Line Company	Bronte field to Midland-Atreco 10-in. carrier, West Texas	6	4	.....	This discharge line and a field gathering system was completed in April.
Buckeye Pipe Line Company	Lima to Toledo, Ohio	82	22	.....	Anderson Bros. Corp., Houston, began construction in April. Line will parallel existing 22-in. carrier.
Humble Pipe Line Company	Double Bayou and Anahuac fields, Chambers Co., U. Texas Coast	5 7½	5 6	....	Completed in May. Completed in May.
	Replacement of 5-in. on Albany to Putnam line, Shackelford and Callahan Counties, West Texas	5⅛	8	.....	Completed in May by Royce L. Boyd Co., Inc., Cisco, Tex.
	Susan Peak field, W. Tex., to San Angelo Sta., West Texas-Comyn trunk line	10	6	.....	Surveying started in April for this discharge line and a gathering system for the field.
Interstate Oil Pipe Line Company	To be laid near Larose, LaFourche Parish, Louisiana	12	8	.....	Latex Construction Co., Houston, started work in April.
Mid-Valley Pipeline Company	Longview, East Texas, to Lima, Ohio	1000	22	150,000	Mid-Valley was recently formed by Sun Oil and Standard of Ohio. This proposed $56 million line will deliver crude to organizers' Ohio and Kentucky refineries and is scheduled for early 1951 completion.
Panoter Pipe Line Company	North Snyder field, Scurry Co. to Colorado Sta. on Basin Pipe Line System, W. Texas	22	6	.....	Surveying for this discharge line and gathering system in N. Snyder fild. was started in April.
	Colorado Sta., Basin System to Coltex Refg. Co.'s Colorado City refinery, W. Texas	17	6	.....	A proposed extension to the above scheduled line.
Plains Pipe Line Company	Mush Creek field to Lance Creek field, Wyoming	50	8	.....	Construction started May 1 and to take about 4 months.
PRODUCTS LINES					
Queont Pipe Line Company	Montreal, Quebec, to Toronto, Ontario, Canada	330	.....	.....	British American, McColl-Frontenac, and Shell organized Queont to deliver from their Montreal refineries. Line is in planning stage and will cost $15 to $20 million.
Sinclair Refining Company	Marcus Hook to Philadelphia, Pennsylvania	26	8	.....	John Meehan & Son, Phila., and Ralph Hopple Construction Co., Canton, Ohio, completed job in April.
Socony-Vacuum Oil Company, Inc.	Reading Spur on Malvern to Binghamton, N. Y. line	22	6	.....	Completed in April by Midwestern Constructors, Inc., Tulsa.
NATURAL GAS LINES					
Arkansas-Louisiana Gas Company	Waskom field, E. Texas to Columbia County, Arkansas Columbia County to Perla, Arkansas	72 90¾	20 20	200 mln 140 mln	Application for these projects made to FPC. Both lines would tie into existing company lines and were estimated to cost $8 million. Three river crossings would be made.
Cities Service Gas Company	Additional compressor facilities, Hugoton-Kansas City line	.....	.....	.....	FPC authorization granted for additional 4790 hp on partially completed 400-mile line.
Colorado Interstate Gas Company	Hugoton to Denver line, Loop	38	20	62 mln	Application to FPC to loop near Denver and to add 12,000 hp to boost system capacity to 326 mln per day.
East Tennessee Natural Gas Co.	TGT line at Greenbriar, Tenn. to Atomic Energy Plant, Oak Ridge	172	22	60 mln	FPC authorization granted. To begin June 15 and completed by Jan. 15, 1950. Estimated cost is $9.4 million.
El Paso Natural Gas Company	San Juan Basin, N.W. New Mexico to El Paso's proposed 26-in. line near Needles, Calif.	451	26	165 mln	New application to FPC replaces original made by San Juan P. L. Co. Project costing $32 million would also include 95½ miles of feeder lines and 175 miles of branches to 6 Arizona communities. Line would deliver 150 mln to PG&E carrier for San Francisco Bay area.
	Dumas, Tex. Panhandle to Eunice, New Mexico	251	24	.....	Completed by company crews. Built to supply N.M.-Calif. system.
	TXL field, Ector Co. to Keystone field, Winkler Co., W. Tex.	18	16	.....	Completed by company crews to supply Calif. line.
Kansas Light & Power Company	Ulysses to Pratt, Kansas	146	20 & 22	.....	Work started by M. E. White & Co., McPherson, in April.
Mississippi River Fuel Corporation	Monroe field, Louisiana to St. Louis Loop	219	24	130 mln	R. V. Potashnick, Cape Girardeau, Mo., started laying pipe May 15 and expects to complete Nov. 15. Contracts for 2 compressor stations not let.

(CONTINUED ON NEXT PAGE)

Pipe Line Construction (Continued)

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
New York State Natural Gas Co.	Sargeant Twp, McKean Co., Penna., to N.Y. State line sta. Potter Co., Penna., Loop	44¼	16	.....	Construction under way by Williams-Austin Co., Coudersport, Penna. Scheduled to complete Aug. 1.
Oklahoma Natural Gas Company	Chandler to Blanchard, Okla. Take up, recondition and re-lay	65	12	.....	Contract awarded to Trojan Construction Co., Inc., Okla City. Scheduled to start about June 15.
Pacific Gas & Electric Company	Needles, Calif. to Milpitas terminal, San Francisco area	506	34	150 mln	Line will connect with El Paso Natural at Calif.-Ariz. border. Bechtel-Price-Conyes, San Francisco, has contract and is expected to start soon.
Phillips Petroleum Company	Gathering system near Hansford Sta., Tex. Panhandle	177	3 to 24	.....	Vaughn & Taylor Construction Co., Wichita Falls, started in April.
Southern Union Gas Company	Tippett field, Crockett Co. to McCamey, Upton Co., W. Tex.	10	4	.....	Line to cost $120,000 and was started in April.
Tennessee Gas Transmission Co.	Main line looping from Cent. Louisiana to No. Tennessee	155	30	.....	FPC authorized this part of a larger project designed to increase system capacity to 1 billion daily. This looping will enable TGT to deliver 60 mln a day to East Tennesee Natural for Atomic Plant, Oak Ridge.
	W. Monroe field, Louisiana, to Ark-La. state line, Loop	57	30	.....	Company crews started in May and expect to complete Aug. 31.
	Tomball, Harris Co. to San Jacinto-Polk Co. line, U. Tex Coast, Loop	53	30	.....	Morrison Construction Co., Austin, Tex., started in May, and expects to complete by end of August.
	Bronson, Sabine Co., E. Tex. to Negreet, Sabine Parish, La.	29	30	.....	Work got under way in May by Morrison Construction Co.
Texas Gas Transmission Corp.	Carthage field, E. Texas to Lisbon field, Louisiana	110	20	.....	N. A. Saigh Company, San Antonio, will lay this line.
	Lisbon field to Mississippi River, near Greenville, Miss.	101	26	400 mln.	This work will be done by Latex Construction Co., Houston.
	Mississippi River crossing to Lula, Mississippi	90	26	400 mln	O. C. Whittaker Co., Ft. Worth, will build this part of line.
	Memphis, Tenn. to Slaughters, Kentucky	210	26	400 mln	Horrigan Construction Co., Houston, 2 spreads on this section.
	Slaughters to Ohio River, near Louisville	180	26	400 mln.	Two spreads of Williams Bros. Corp., Tulsa, will do this work. Lula to Memphis section has been constructed. Stone & Webster will construct the 10 compressor stations.
Transcontinental Gas Pipe Line Co.	McAllen, S. W. Texas to New York City	1840	20-26-30	340 mln	Fish Constructors, Inc., Houston, was scheduled to start laying pipe in May, beginning at Eunice, La., and working northeasterly towards Atlanta. Fish will work six spreads this year.
Trunkline Gas Supply Company	Edge, Brazos Co., U. Tex. Coast to Palmyra, Nebraska	711	26	250 mln	FPC in authorizing changed route from Louisiana-to-Iowa to present plan. Project, including 7 stations of 44,800 hp, will cost $84,340,300 and must be started by July 1, 1950 and muts be complete by Oct. 27, 1951.
	Supply lines to Texas & Louisiana gas fields	810	22	.....	

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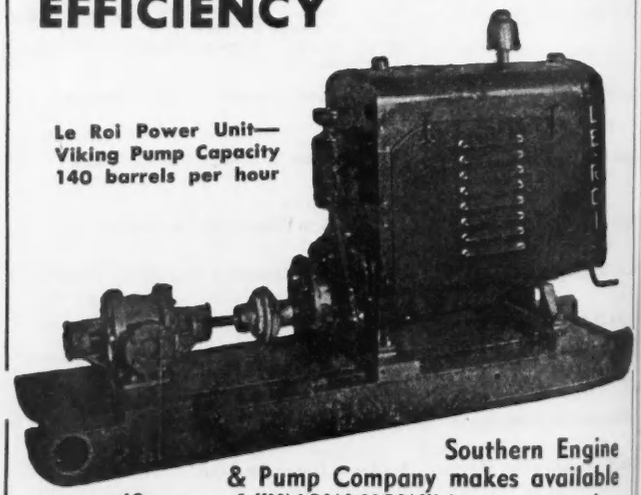

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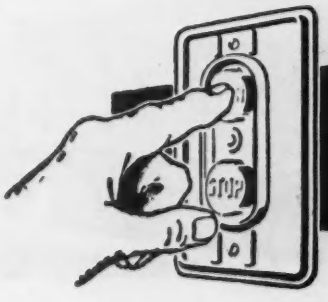

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PIPE LINE HINTS

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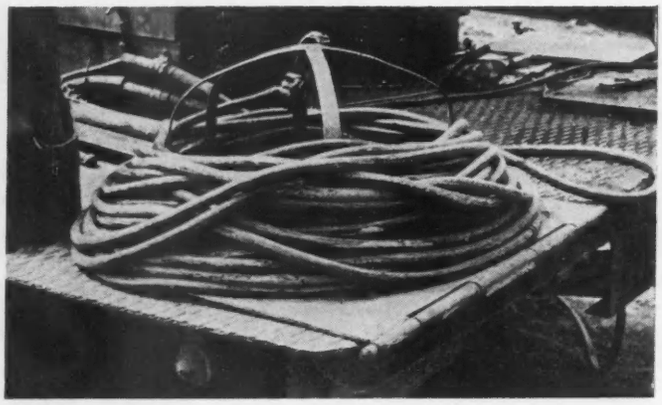
HOW TO—Rack Electrical Welding Cables for Safe Handling

Racking long cables used on electrical welding units that have been truck-mounted always poses a problem. Much can be done to minimize abuse through proper handling when these cables are transported between jobs.



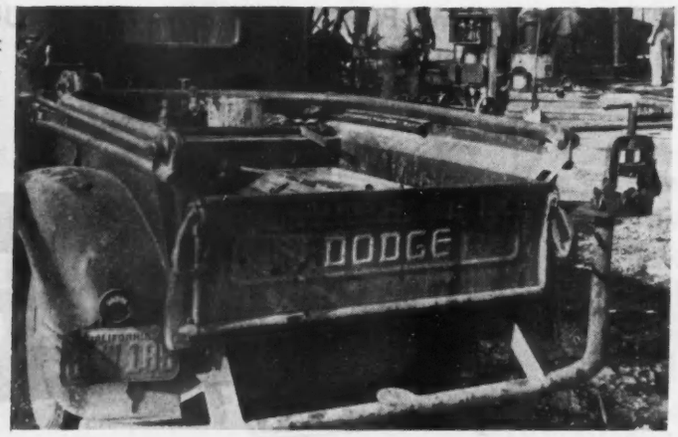
Much time has been saved and abuse minimized through the application of a shop-made cable reel as illustrated. The reel itself has been mounted on a hinged section of one-fourth-inch steel plate about 30 inches on each side. Four steel strap pieces were tack-welded to this plate on a 24-inch circle and bent to meet at a common point at the center as shown. The bent contour of each piece facilitates coiling the cable on the reel, since the heavy conduit will fall in place around these guides.

A feature of this rack is one which has been incorporated into the hinged section that provides almost instant unloading of the cable. The reel plate has been hinged to the rear of the welding truck as shown. A small longitudinal shoulder was welded in the center of and on the opposite side of the hinged plate. By lifting the reel and hinged plate, and throwing it over, thereby turning it upside down, the entire cable is thrown upon the ground ready for immediate use. The shoulder stops against the truck bed and holds the reel in a horizontal position. The device has saved considerable time and effort in caring for electric cables used on this welding unit.

A unique fire extinguisher rack was made for this unit by using a short section of salvaged line pipe. The pipe was cut with a torch to form three vertical arms, one of which can be seen at the left of the illustration. The rack is welded to the truck bed, and the three arms bent in such a manner to provide a spring hold on the extinguisher when inserted in the rack.

HOW TO—Equip Field Pick-Up Truck with Collapsible Mast

The numerous uses of the light pick-up truck in oil field work are considerably increased by the addition of a light A-frame or hoisting mast with which heavy or bulky objects may be picked up and carried. The light collapsible framework devised by one company, shown in the collapsed position, has the principal advantage of requiring very little of the bed space when the unit is in the retracted or lowered position.



Along each side of the pickup bed is welded a strip of steel plate, the legs of the U-shaped principal mast member being bolted and hinged to the rear of these rigid pieces. Height and width of the mast are determined by the truck dimensions between the rear gate and the cab and the width of the body. As the mast is raised, supporting legs are raised with it. These braces are then positioned by bolting in any pair of a number of holes drilled at intervals along the forward part of the rigid side members. A small hand-operated hoist positioned in one corner of the truck bed has sufficient line capacity to allow taking the line to a reasonable distance from the back of the truck for attaching to the load to be picked up.

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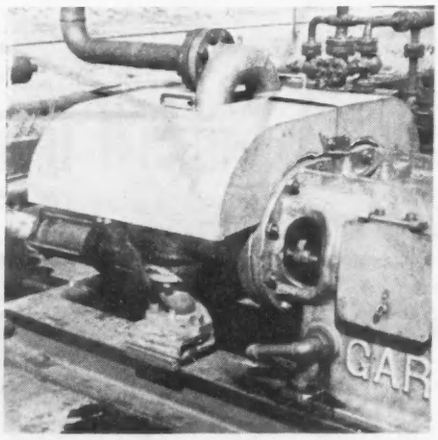
HOW TO—Cover Fluid End of Pumps to Protect Nearby Equipment

As a protective device for surrounding equipment if a gasket should break, a steel cover on the fluid end of high-pressure pumps localizes the spray of oil, and at the same time the cover shields the fluid end from rains and inclement weather.

Two sections form the cover, each section approximately identical in form and dimensions. Main part of the cover is a rectangular piece of sheet metal about the weight of tank deck steel, welded to two side members which are cut with a torch to obtain the desired shape. Dimensions will vary according to the size and design of the pump.



Side pieces are trimmed on the lower side to follow the contour of the flange of the bed plate of the pump so the section will fit snugly and with a minimum amount of open space. A recess is cut in the top of the cover for the discharge loop and a heavy bail type handle is welded at a point on the cover where balancing will result. In the center of the outer edge, there is welded a lip having a hole to receive a bolt to attach a diagonal brace reaching to a flange bolt of the pedestal of the fluid end. Loops are welded at each upper corner to slip over the stud, or anchor bolt, to hold the cover solidly in place.

HOW TO—Anchor Hot Gas Pressure Lines to Prevent Misalignment

Controlling the movement of pressure maintenance lines in an area where an extreme range of temperature is the usual occurrence can be accomplished with large expansion loops, but the "give and take" of the pipe on the sides of the loop presents a problem where guiding is necessary. This control or guidance can be done with a slide-type bearing which not only supports the pipe above the ground surface but maintains the original alignment during expansion and contraction.

Two pipe nipples, made of discarded

liners or any type of tubular material not in condition to be used elsewhere, are joined with a cross member to which a piece of channel iron is welded, with the channel side resting on the cross member so that the outside flat surface is on the upper side. These posts are set in holes grouted with concrete so as to be a permanent unit. One-inch, or larger bolts are set in the open ends of the pipe and grouted with concrete flush with the top edge of the opening. The pipe loop laid on the supporting cross member is fitted with two pieces of channel iron, one on the top and the other on the bottom to form a square surface.

An additional piece of channel iron is perforated with two holes, one near each end to coincide with the bolts in the

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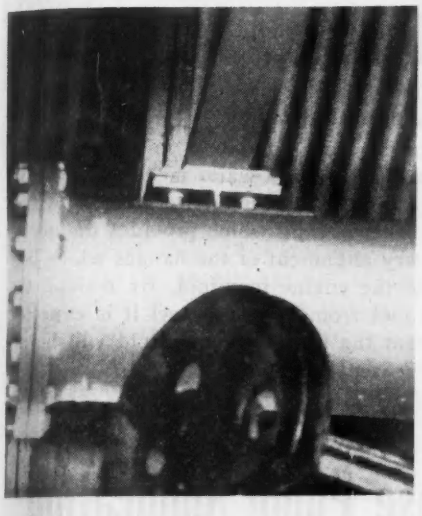
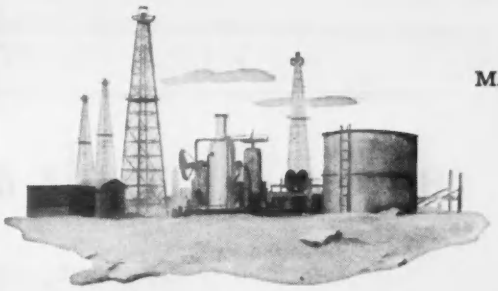
pipe and placed in position with the flat side downward against the pipe loop. A heavy helical spring placed over each bolt above the channel iron cross member supplies the required pressure to hold the pipe firmly in place when nuts are drawn tightly down when screwed on the bolts.

HOW TO—
Support Overhead Pipe



To eliminate stanchions or posts to support overhead piping in a pumping station the transverse beam of the roof truss can be adapted as a support for the headers. A wide and heavy steel pad was welded to the roof truss at a point where the pipe was to pass beneath, drilled to receive four machine bolts of the correct length, to be inserted with the heads uppermost. On the line where it was to pass beneath this roof truss pad, a similar piece of metal was attached by welding. This pad, however, was obtained by cutting a section of 'H' beam so that the web on the side retained could be shaped as a sort of saddle to conform to the contour of the outside of the pipe. This pad was welded to a companion saddle, pad-shaped with an arc to lie flat on the pipe where it was permanently welded. Steel machine bolts passed through the holes in both pads have nuts threaded tightly on the lower ends to draw the line snugly against the pad on the roof truss so as to support the weight of the pipe and fittings without stanchions.



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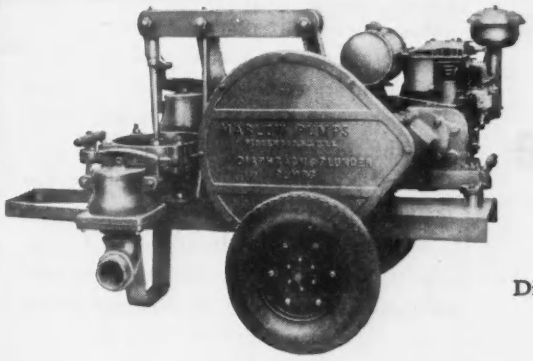

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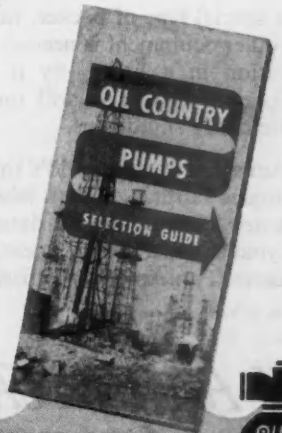

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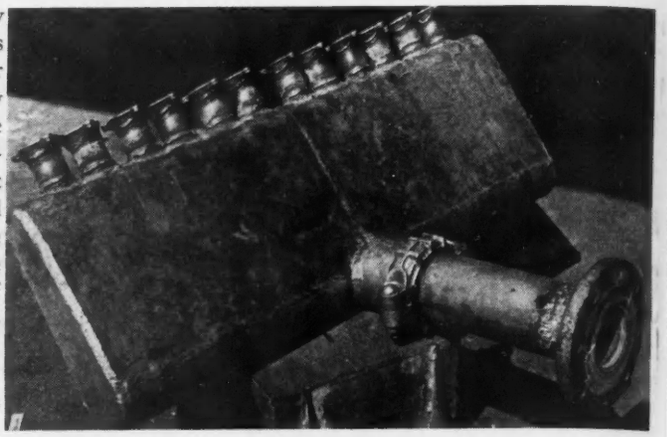
HOW TO—Extend Life of Exhaust Manifolds



Pipe line companies have successfully adapted war surplus airplane engines for use as stationary power plants. To use these engines, however, new exhaust manifolds are needed which as a rule are fabricated to fit the particular needs of the engine application.

One problem encountered in these custom-made manifolds has been the deterioration of the steel pipe used for the connection directly to the engine. Temperatures at this point reach 1600° F., and the portion of the 14-inch pipe that is exposed to the atmosphere has lasted only about one year.

This problem has been solved by replacing the steel pipe with stainless steel tubing, type 304. The illustration shows a typical manifold. The main body is made from 3/16-inch mild steel plate and serves as a water jacket. The twelve stainless steel tubes are welded to this jacket in a jig which provides the necessary alignment of the flanges which bolt to the engine manifold. By making the tubes from stainless steel it is expected that the life of the manifold will be increased four times.

HOW TO—Double Up Lease Pump Application

Where the producer contracts to pump the oil from the lease storage tanks into the pipe line, the few added connections will permit using the same pump to transfer oil on the lease. Three connections shown at the right are in the pipe line leading from the tanks in the background. One line is the inlet into the pump while the other two are on the discharge. A block valve in the line near the pump permits circulation so that the pump can be run when the discharge is shut off.

The other connections to the pump are made on the lease side of the tanks. The oil can be transferred from one tank to another, or emulsions can be circulated through the crude treating plant. Still another connection that takes off from the discharge runs to the flow line header. This permits pumping oil back down the flow line from any of the wells in case oil is needed for circulation in workover jobs or in bringing in a new well.

Forethought and planning make it convenient to use this pump for many purposes and actually makes it easier on the pumper than if he had two or three pumps to maintain.

Imperial Oil Severs Inter-Pete Ties

THE SALE by Imperial Oil, Ltd., of its controlling interest in International Petroleum Company, Ltd., has severed a 34-year-old link. This article reveals why the transaction was made and describes its probable far-reaching effects on Canada's petroleum economy.

Imperial's discovery at Leduc, Alberta, was an important step in establishing Canada as an oil province with sufficient promise to justify the company's entire attention.

THE SALE by Imperial Oil, Ltd., of its controlling interest in International Petroleum Company, Ltd., for $80 million brought to a close an association which was unique in the oil industry and emphasized the growing importance of the new oil discoveries within Canada's borders. Funds realized from the sale will be used by Imperial in developing the potentially large reserves which are apparently destined to convert Canada from a "have not" to a "have" nation insofar as petroleum is concerned.

International Petroleum played a major role in supplying Canada with South American oil. Imperial will still buy oil from International Petroleum and Canadians will still have the benefit of two-way trade with the nations of South America.

It is expected that future earnings of Imperial's ventures in the new Canadian fields will more than offset the revenue obtained from its holdings in International and that these new investments will help to make Canada less dependent on foreign supplies of oil.

With Imperial as the parent company for 34 years, the two enterprises had been linked together in a close association which now will continue in a different form. At the beginning of the association International's activities were concentrated in Peru, but they have since spread to Colombia. In both countries International is concerned with exploration, production, transportation and refining, and with marketing petroleum and its products. In addition, International ha. an agreement with the Mene Grande Oil Company involving 25 percent of Mene Grande's production in Venezuela.

Marketing activities are confined to Peru and Colombia, and about half of the crude produced is required to supply domestic markets in these countries. The rest of the crude or products is sold in world markets. A subsidiary, the Andian National Corporation, operates a pipe line from El Centro, Colombia, to Cartagena, 335 miles distant.

The sale, with proceeds to be used for Canadian development, recalls the year of International's founding. Back in 1914, the Imperial Oil Company, Ltd., as it was then known, was afflicted with growing pains. Its manufacturing facilities were expanding; its marketing and distribution outlets were being increased and the important role it was destined to fill in the industrial and agricultural development of the Dominion was apparent to those who guided its destinies.

Then, as now, Canada was an oil importing nation. Then, as now, there were experts who foresaw the early exhaustion of the world's oil supplies, particularly the reserves in the U. S. which dominated the petroleum situation to an even greater extent than they do today. Then, as now, there was raised the cry of "self-preservation" and the U. S. government was being urged to curtail export of its dwindling resources.

Looking back on what has happened in oil during those intervening years we may be inclined to smile at the prophets of gloom, but the then leaders of the oil industry had no crystal ball and, faced with a dim and uncertain future, were forced to take whatever action seemed best calculated to insure continuity of their vital supplies just as, today, the industry experiments with hydrogenation and synthesis.

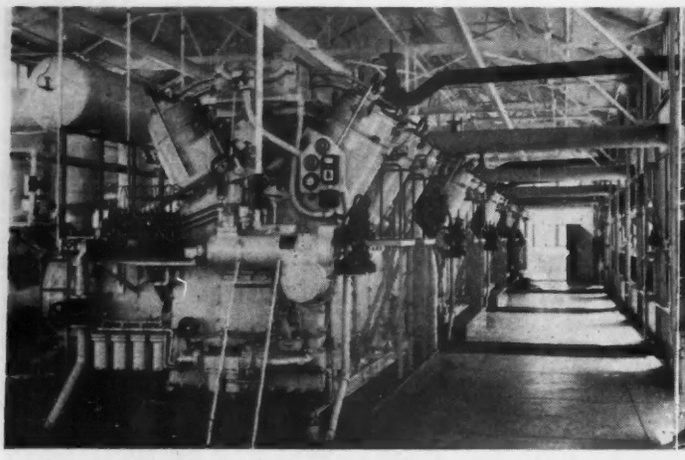
Visualizing the hapless state of a Canada deprived of U. S. crude, the directors of Imperial Oil took decisive action to avert such a catastrophe by assuring for the Dominion an independent and accessible source of supply and "Inter Pete" was born.

Looking at a world oil map of today the uninitiated might be inclined to wonder why the International Petroleum Company, Ltd., chose Peru as the seat of its activities and not one or other of the vastly richer, in an oil sense, South American republics. But in 1914 Peru was the only sizeable oil producing country on that continent; Argentina was contributing only a few thousand barrels annually, while it was not until three years later that Venezuela started the spectacular rush which has placed her second among all nations in oil production.

Peru entered the production column in 1884 and, when International Petroleum came on the scene, was producing around 2 million barrels annually, no mean achievement in those days.

But the petroleum industry of Peru goes much further back than the era of statistics! When the Spanish crown reached over the uncharted seas to establish a colonial empire, the all-conquering Dons found the Peruvian Incas dabbling in oil. With true paternalism they created these "brea pits" a government monopoly, and so they remained until the wars of liberation.

Modern oil development in Peru may be considered to have had its genesis in 1875 when Don Genaro Helguero acquired the Hacienda La Brea y Pariñas. This paved the way for International Petroleum, which was incorporated in



Compressor room in one of International's repressuring plants in the Talara area, Peru.

Modern refinery at Talara which regularly processes 28,000 barrels of crude daily.

Canada in 1914 as a subsidiary of Imperial Oil.

La Brea y Pariñas estate is situated in the most westerly extremity of the South American continent and in the northwestern coastal area of Peru. The terrain consists of salt flats and sand dunes, the only vegetation being found in the deep gullies, or quebradas, carved out of the loosely consolidated surface by the torrential rains which occur about twice in a generation. The climate is influenced by cold sea currents from the Antarctic and is neither too hot nor too cold, this particular area lacking the tropical aspects which prevail both to the north and south.

The geology of the estate might be likened to a huge anticline which, at some time in the dim past, had collapsed in ruins, leaving a hodge-podge of separate blocks bounded by "faults," or fractures in the strata, and tipped and tilted at various angles.

International spared no effort to unravel the complex geology of the estate. Dr. T. O. Bosworth made a preliminary survey in 1916 and the geological department made a modest beginning in 1920. As the years went by the department grew in numbers and in the scope of its investigations; specialists in various phases of geology not only worked out the problems governing the accumulation of oil but, in so doing, made a valuable contribution to scientific knowledge. Geophysical methods of exploration were utilized and the benefit of those intensive researches was apparent in the gradual expansion of the productive area.

The success which has attended development may be gauged from a few random statistics.

Of the estate's entire area there are roughly 347,000 acres considered to consist of strata suitable for oil occurrence and latest available figures indicate that a total of 18,340 acres has been developed. At the close of 1948 there were 2510 producing wells in the field, together with 627 abandoned producers and 757 dry holes; a total of 3894 wells drilled of which only 19 percent were unsuccessful.

Production had aggregated 299,841,756 barrels; the peak year being 1936 with 15,126,490 barrels. The year 1929 saw the maximum drilling activity with 205 completions, of which 177 were productive and 28 abandoned; 1947 set a new footage record with 345,237 feet of drilling.

Coincident with operations in the field plans were carried out to bring the maximum of efficiency into every phase of the company's endeavors.

Refining facilities were completely modernized and refining capacity largely increased. Cracking units were introduced in 1927 to augment motor fuel output. The plant now has a capacity of 30,000 barrels daily.

Port Expanded

The port of Talara was transformed by the addition of a concrete mole and accommodation provided for tankers of 15,000 tons; larger vessels are served by a 12-inch, mile-long sea line. Immense storage tanks with a capacity of more than a million barrels ring the port.

In 1922 the first of a series of casinghead gasoline plants was put into commission to strip all gas before diverting it to its several uses. Six such plants are now operating and add considerably to the production columns.

International Petroleum was a pioneer in gas-lift and repressuring with results which have been extremely beneficial. The company enjoys the privilege of unit operation in the field, a condition which is essential for success in any repressuring scheme.

In the field of economics the expanding importance of its oil industry has meant much to Peru. New world markets have been opened for Peruvian raw material and now its exports of petroleum exceed in value its exports of copper. Its internal trade and commerce have been revolutionized by a ready and inexpensive fuel supply for industry, lubricants for its manufacturers and gasoline for its motive power. Immense areas of its hinterland have been opened up by asphalt-covered highways which link the inland cities with the seaports to the advantage of both.

Through the years of steady expansion the oil industry has contributed a substantial and dependable quota to the national exchequer, has helped materially to finance altruistic schemes for the welfare and benefit of the Peruvian people and has assured them of a fair share of this natural resource.

Such material benefits are not merely fortuitous but are the logical outcome of the forethought which International Petroleum has devoted to the systematic and economic development of La Brea y Pariñas in accordance with a well-ordered policy, backed by the latest refinements of invention and science and subsidized by adequate capital.

With Peruvian operations well underway, International next turned to Colombia. There the company operates through a subsidiary, Tropical Oil Company, which was acquired in 1920. This company operates a property known as the de Mares Concession, which is 350 miles up the Magdalena River, and covers an area of about 2061 square miles.

After the acquisition a drilling campaign was begun. Initial progress was slow, as roads had to be run through hilly jungle country, and camps and shops built. By 1932, 681 wells had been drilled, and 654 of them were producers. At the end of 1948, 971 wells were producing 32,200 barrels of crude a day.

During 1921 crude production averaged 182 barrels a day and output was increased with continuing development until production reached a peak of 55,

846 barrels a day in 1929, placing Colombia eighth among the world's oil producing nations by Tropical's production alone.

In 1922 a refinery was built at Barranca Bermeja to serve the needs of Colombia, and the average daily crude run then was 545 barrels a day. This figure has increased steadily, and the refinery now has a capacity of 20,000 to 24,000 barrels per day. Bulk stations were built along the Magdalena River, and distribution made by Tropical's own fleet of steamers and river barges.

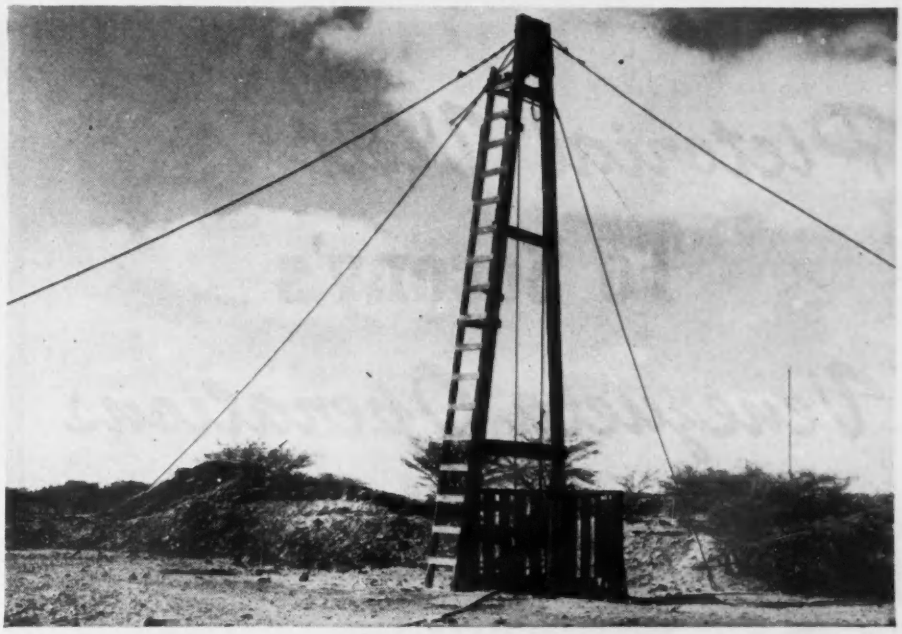
In 1926 the Andian National Corporation, another subsidiary of International Petroleum, put into operation a complete pipe line system to transport the de Mares crude and bunker fuel to the seaboard at Cartagena. This line carried about 38,000 barrels a day in 1947.

At Cartagena Imperial tankers load crude for its long journey to refineries at Halifax or Montreal, or it may be landed at Bayway, N. J., and run through the U. S. network of pipe lines to the refinery at Sarnia. Through its agreement with the Mene Grande Oil Company in Venezuela, International last year obtained 47,500 barrels of crude oil a day. International maintains executive offices in Caracas, and accounting offices in Maracaibo.

The destinies of the company have rested in the capable hands of only four presidents since its inception. Walter C. Teagle, the original chief executive, was succeeded by the late G. Harrison Smith. The late R. V. LeSueur followed Smith and since 1945 the president has been L. P. Maier.

Mere figures do not begin to tell the story of what International has accomplished; behind the statistics lies an epic of modern industry.

The huts of a scant population of fishermen at Talara have given place to orderly streets of ideal homes, centered around churches, schools, hospitals, clubs, cinemas, firehalls, and stores. A network of pipe lines gathers oil from every part of the developed field, for delivery to the refinery.



Discovery well in the Talara district, northwestern Peru. Brought in during the 1850's this well still produces oil. It was dug like a water well and walled with stone.

All this means that individuals and families have been taken from tasks providing but a precarious livelihood and given the opportunity of becoming skilled workers in remunerative channels of employment. Their children have been educated and brought into touch with modern ways of living and trends of thought. Epidemic diseases, at one time all too common, have been curbed. In this extreme corner of Peru there has been established a nucleus of progress which cannot but have a far-reaching effect on national advancement.

In Colombia as in Peru living conditions have undergone a constant improvement. Road and rail provide transport through the jungle; an adequate water supply has been installed; churches, schools, a cinema, and a well-equipped hospital have been built at El Centro where the improved conditions are reflected in the decline in the malaria rate. Infections dropped from 845 per thousand in 1926 to 30 per thousand in 1932, and the rate has dropped to even lower levels in recent years.

While all these developments brought many benefits to South American countries, Canada benefitted as well. South American oil, brought northward to the Dominion, gave Canadians fuel and power and lubrication for their homes, industries and transport. It aided the war effort and it will continue to provide a source for the petroleum which is vital to modern living conditions.

ACKNOWLEDGMENT

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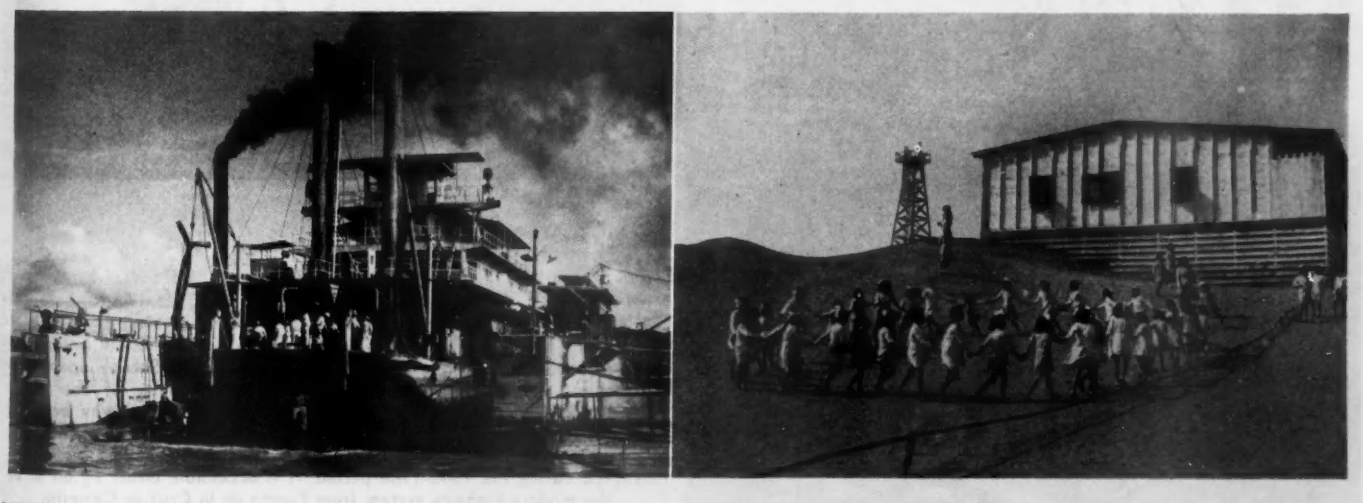


LEFT: One of eight all-steel river boats owned by Tropical Oil Company, International's Colombia subsidiary, on the ways of a floating drydock operated by the company at Barrancabermeja, on the DeMares concession. RIGHT: Rural school for children of the workers in the Lomitos field, part of the producing region at Talara.

Pictorial Visit To Socony's *Venezuela Operations*

Socony geophysicists have named this seismograph field base their "Lone Pine Camp." It is in the broad Ilanos regions of Eastern Venezuela where the greater part of the company's operations are concentrated.

☆

Truck-mounted rig being dispatched from the company's base camp at Anaco for use in exploratory work. Structure drilling plays a major role in Eastern Venezuela prospecting. The region is well suited to comparatively easy movement of equipment, and stratigraphic conditions are such that few wildcats are drilled without first checking the geophysical surveys by intensive structure drilling.

☆

☆

Aerial view of the Anaco camp, headquarters of all Socony operations in Eastern Venezuela. It is in the immediate vicinity of the firm's Guario field, south of Puerto de la Cruz, and about midway between operations at Guico and Nipa of the Greater Oficina area, and the port. This is one of the most modern camps in Venezuela, having been constructed during the 1946-1948 period. It is accessible either by air or by the modern highway system from Puerto de la Cruz or Caripito.

School for children of American employes in the Anaco area. The company also provides medical and recreation facilities.

☆

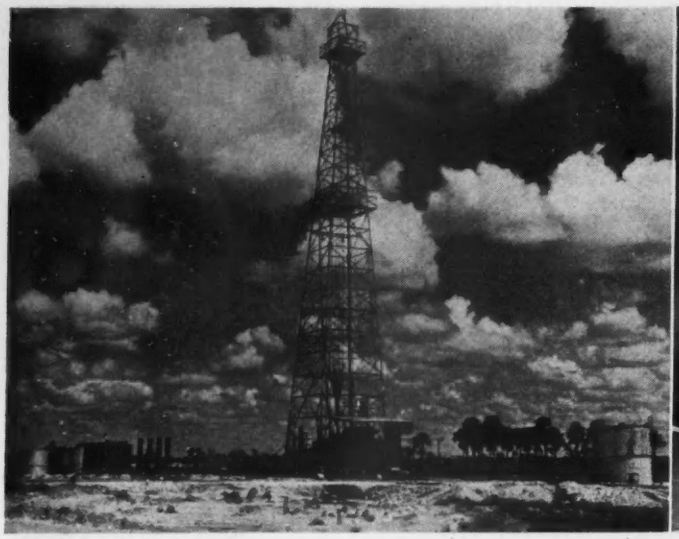
Drilling well in the remote Barinas area, where Socony has discovered oil, but which has not yet been provided with an outlet. The drilling program now in progress will determine whether the area will justify the great outlay for transportation facilities.

☆

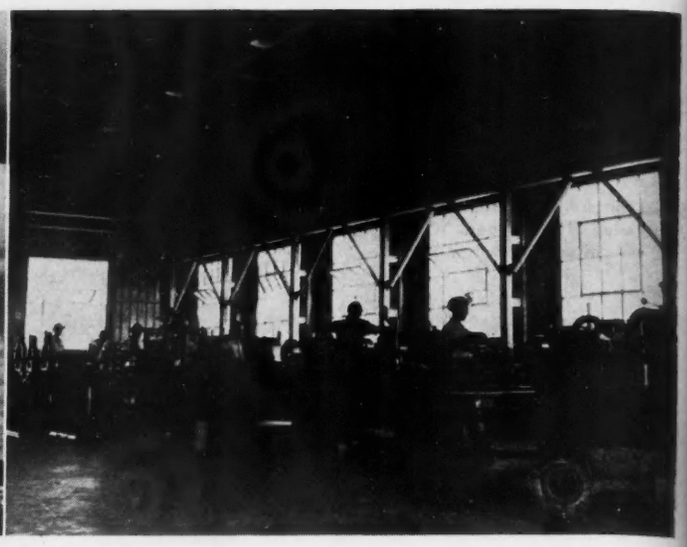
Unloading pipe in the warehouse yard at Anaco. Casing and other supplies arrive at Puerto de la Cruz by freighter and move by truck to this central point, from which distribution is made to the individual operating areas. The warehouse yard is part of the "industrial area" of the camp which contains machine shops, garages, power plant, ice plant and other installations.

☆

Power units in the pumping station at Anaco, part of the 12-inch pipe line system serving Socony's producing fields. The line is capable of handling 60,000 barrels of oil daily between Anaco and the terminal at Puerto de la Cruz.



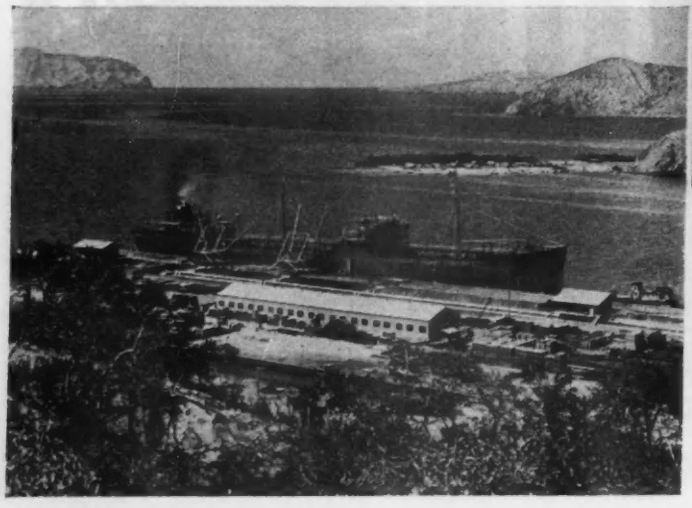
Drilling well at Nipa, one of the most important Eastern Venezuela sources of crude oil production.



Interior of Socony-Vacuum machine shop at Anaco. Such facilities are an important part of operations in remote areas.

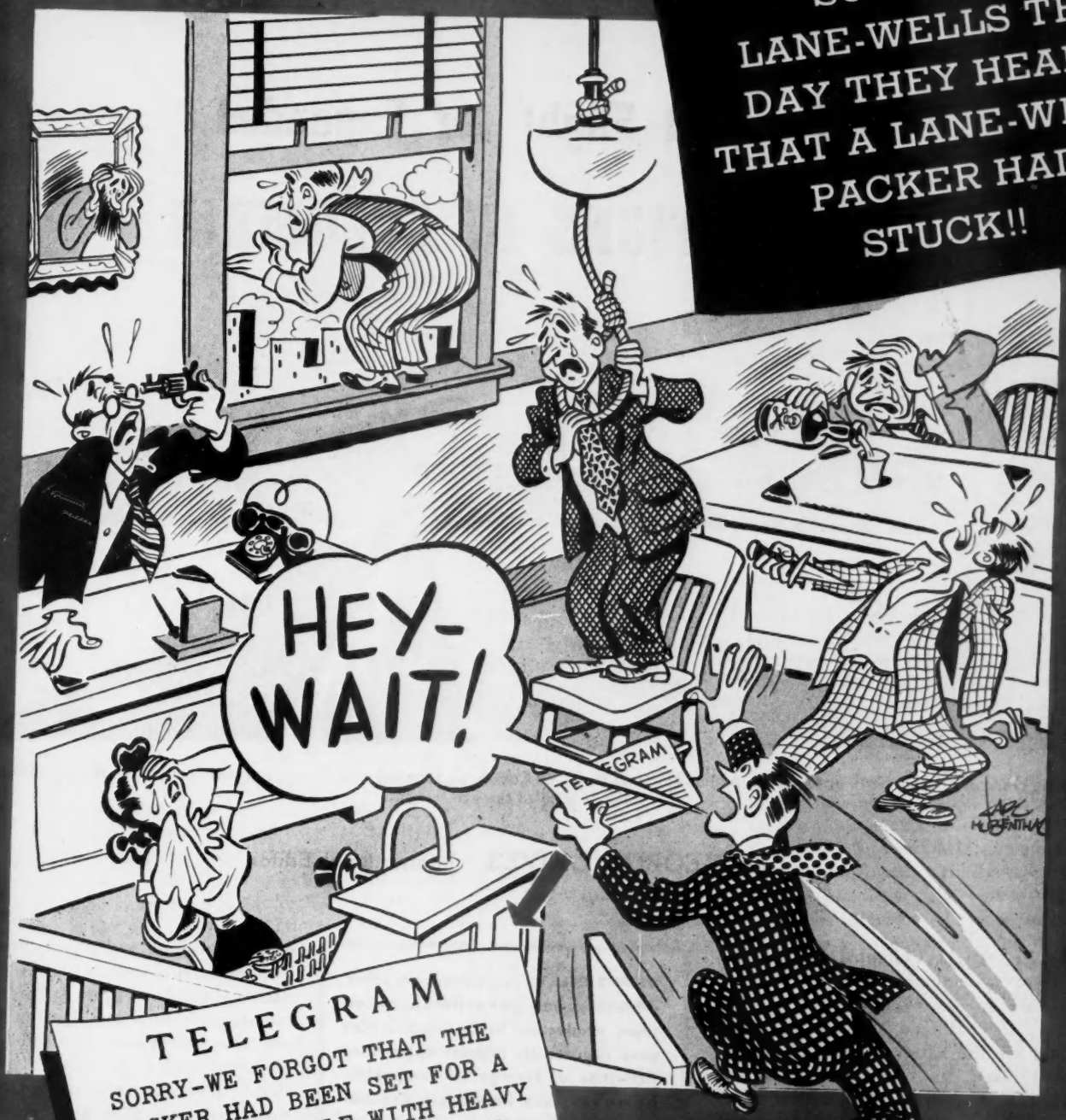
Typical staff residence in Anaco camp. Most residential structures are of concrete block construction with spacious, well-ventilated rooms and tile composition floors.

Venezuelan crew on derrick floor at a drilling operation in Eastern Venezuela. Other than tool pushers, most of the drilling personnel are Venezuelan nationals.



Socony-Vacuum's tanker Camp Namanu, loading Venezuela crude oil at the Puerto de la Cruz terminal for transportation to the New York area. Loading conditions here are ideal. Storage and loading tanks are so situated that loading is by gravity, and deep water which never needs dredging starts from the shore line itself.

SCENE AT LANE-WELLS THE DAY THEY HEARD THAT A LANE-WELLS PACKER HAD STUCK!!



TELEGRAM

SORRY-WE FORGOT THAT THE PACKER HAD BEEN SET FOR A YEAR AND A HALF WITH HEAVY MUD IN THE ANNULUS ABOVE IT. AFTER WE CIRCULATED OUT HARDENED SETTLINGS, PACKER WAS PULLED WITHOUT TROUBLE, AND IS STILL IN GOOD SERVICE CONDITION.

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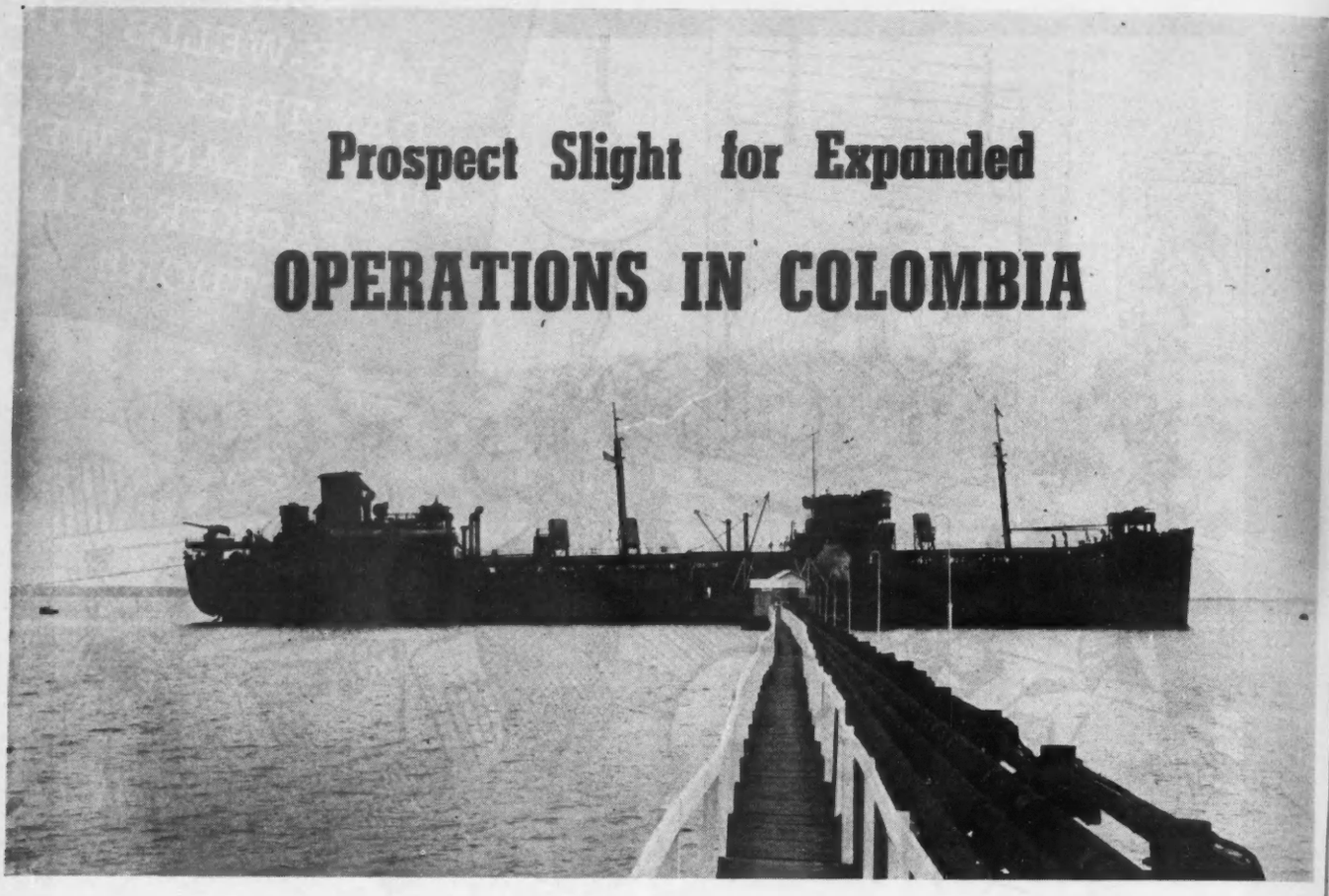
Prospect Slight for Expanded

OPERATIONS IN COLOMBIA



Loading crude at offshore berth at Mamonal, Andian National Pipe Line Company's terminal near Cartagena. Oil from all of the Magdalena Valley fields is handled through this port.

By GEORGE O. IVES, International Editor

DESPITE DELAYS resulting from labor difficulties and governmental red tape, production in Colombia last year reached its highest daily rate. Activities of foreign oil companies, however, are being curtailed because of the problems and increasing costs involved in operations in that country. A survey of current activities in Colombia indicates that unless the situation can be improved, the likelihood is dim for expanded exploration and production.

ALTHOUGH Colombia ended the past year with the highest daily producing rate it has ever enjoyed, a rate which, if continued through the year would see the nation top the 30-million barrel mark, its total production was seriously affected by a continuation of the difficulties with which the producers have been seriously beset during the past few years. Two prolonged strikes of oil-field labor kept the nation from reaching a new high. One of the strikes occurred on the DeMares concession and resulted in operations being closed down for 50 days, while another on the Barco concession lasted 40 days.

Currently the labor situation has quieted to the point where it is possible to continue producing without interruption, and the output remains in excess of 82,500 barrels a day, a rate which has been maintained through the past several months. The extent to which such a level of production can be prolonged actually depends on developments in two principal producing fields. Unless other important production is found shortly the burden of keeping up the nation's yield will fall upon the Casabe field in the Middle Magdalena Valley and the Tibu field on the Barco concession.

For more than two decades the principal source of Colombia's oil has been the DeMares Concession, operated by Tropical Oil Company, which started shipments commercially with completion of the Andian National Corporation's pipe line in 1926. The Infantas and La Cira fields of this concession have together produced more than 378 million barrels of crude, and have accounted for an additional 14½ million barrels of natural gasoline and other condensates, but these fields have definitely gone into declines and have been drilled up to all intents and purposes. During the past year there were no wells drilled in either of these fields, whereas during 1947 there were 96 wells drilled, or more than were drilled in 1948 in the whole of Colombia. It is unlikely that a great deal more development will take place on the concession before it reverts to the government in August of 1951. It is estimated that as much as 100 to 200 million barrels of oil remain to be produced from Infantas and La Cira, which accounted for an output during 1948 of 8,991,322 barrels of crude and 578,797 of condensate. This production comes from 963 wells, only seven of which are flowing.

Tibu Output Increased

Colombian Petroleum Company has improved its position slightly in the Barco, in extreme Eastern Colombia, through an increase of nearly 1 million barrels in the output from the Tibu field, which passed the 5 million barrel-a-year rate in 1948. This served to more than offset a decline in Petrolea, the

LEFT: Preparing location for an exploratory well in the Department of Santander, northeast of the DeMares concession. RIGHT: Seismic geophysical operations in the Lower Magdalena Valley. All equipment for this operation was transported in the field by hand.

Barco's other active producing field which declined from just over 3½ million barrels in 1947 to just over 2¾ million in 1948. Even so the Petrolea field continues as a flush producer with only two of its 41 wells operated by artificial lift. The Tibu field now has 68 producing wells, of which 11 are being pumped. Drilling activity has been maintained at a level rate for the past two years with 20 wells completed last year compared with 19 in 1947. The company still gives considerable attention to drilling stepout wells at Tibu in an effort to define accurately the producing area, and two rigs are kept busy drilling to the Cretaceous pay opened a couple of years ago. Currently a wildcat is being drilled approximately 11 miles northwest of the producing portion of the Tibu field. At latest report it was below 8000 feet, scheduled to the Cretaceous.

Strikes Slow Operations

It must be remembered that declines in production from the DeMares fields, and the relatively slight increase in production from the Barco concession are not altogether a reflection of the ability of the wells to produce at higher rates. A considerable amount of the disparity can be attributed to the time lost through strikes during the early part of the year.

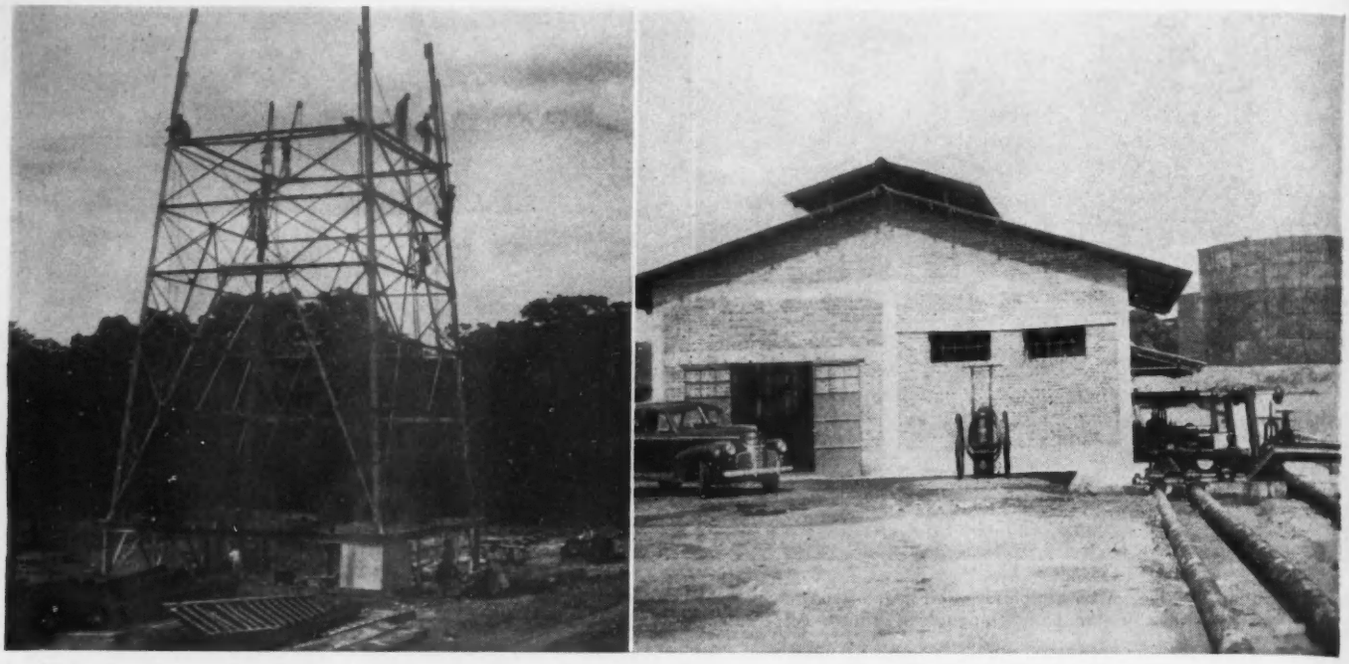
The Shell Group has steadily increased activity in the Casabe and El Dificil fields, and during the past year completed 27 producers at Casabe and six at Dificil. Casabe field, on the Yondo concession across the Magdalena River from DeMares, now has 69 producing wells with a daily yield of 16,500 barrels of oil, and five rigs are being kept busy with development operations. Although the limits of the field have been fairly well defined, there remain many locations within the proven area, and development should continue for a number of years. Dificil, on the other hand, with 11 producing wells, has comparatively few locations left to drill, and with two rigs busy, should complete development within a comparatively short time. This latter field went on commercial production with completion of the combination six- and eight-inch pipe line from the field to Plato station on the Andian system in August of last year. Initial deliveries were at the rate of 3000 barrels a day, but this has been increased to 5000 barrels daily, and the total output for the year was 583,896 barrels of oil.

The Shell Group was also active in exploratory work during the year, drilling two wildcats, and being associated with other companies in the drilling of four others. The results were most disappointing, and two of the wells drilled in the Llanos area east of the Andes are likely to mark the end of Shell's long exploration effort in that region. For several years the company has devoted a considerable amount of time and money to exploration in the Llanos, finding showings of oil in a number of wells, but failing to establish production of commercial scope in any of them. During this time 11 wells were drilled, all dry holes, with an outlay of more than $10 million. The region has been rather difficult to work, more because of transportation difficulties than through the nature of the terrain covered. Much of the material had to be transported by air, including a substantial part of the heavy machinery, and surface transportation for the remainder was hazardous due to the inadequate roads across the mountain ranges. At best the roads were none too good, and frequent delays were caused by landslides which took out great sections of road. Several years ago interest in the region was such that most of the major operators in Colombia acquired extensive concessions, but all work to date has failed to yield encouraging results, and it is unlikely that much more actual work will be done there until legislation is passed making it more attractive to operate. Under present conditions the cost of exploration is considered too great when coupled with the prospect of a huge outlay to establish an outlet for any oil found.

The Texas Petroleum Company also suffered disappointments in its attempt to expand its Velasquez field on the Upper Magdalena River, and has completed only two producing wells to date. The first oil was shipped from the area early this year, having been barged down the Magdalena to Tropical Oil Company's refinery at Barrancabermeja. The two producing wells are expected to yield an average of 700 barrels of 25-gravity oil daily. Two wells were drilled in the field within the past year, both of which were dry.

Exploration in South

The same company has its exploratory campaign in the extreme southern part of Colombia in full swing, having drilled three wildcats during the past year. All were dry, but all reported showings of heavy oil in Tertiary sands. The Curbinata 1, located 24 miles south of Florencia, La Rastra 1, about 30 miles southwest of Florencia, and La Solita 1, about 48 miles southwest of Florencia, all reached basement at comparatively shallow depths, deepest hole being only



LEFT: Erecting derrick for outpost in Barco concession. RIGHT: Pumping station in Casabe field from which oil is sent across the Magdalena River to a connection with Andian National Corporation's trunk line to the coast.

3740 feet. Another well is now drilling in the region. An interesting feature of this operation is that the drilling camp headquarters are built on pontoons and are moved from location to location along the streams of this heavily-jungled region which lies almost on the Equator.

The company is also engaged in deep wildcatting in the extreme northern part of Colombia, and is now drilling deep wells east and west of the city of Barranquilla.

Expansion Unlikely

The Cantagallo field, connected by pipe line in 1947, produced 389,509 barrels of oil during 1948, holding an average of 1260 barrels a day in recent months, and it is unlikely that there will be any expansion of this production, since the field is now defined and limited to the three present producing wells. An effort has been made to find production in the Cimitarra area to the south by Socony-Vacuum Oil Company and the Shell Group, but two wells drilled during the past year were dry. Earlier wells showed some heavy oil, but failed to produce.

In all, 16 wildcats were drilled in the various regions of Colombia without marked success. Most encouragement was given by Texas Petroleum and Socony-Vacuum's Jobo 1, in the Lower Magdalena Valley region which found gas at 6944 feet. Tentative estimates place the potential of the well at 29 million cubic feet daily, but no market for the gas exists. A second well on the same concession was abandoned as dry after drilling to 7504 feet. An interesting test was being drilled by Shell at the end of the year at Rancheria 1 which is the first well drilled in the Guajira Peninsula area. It had reached 6178 feet in basement, but no reports had been given as to showings found.

The proposed new petroleum law has failed to materialize. Since its early approval by the House in 1947 it had been thought likely that action by the Senate would be taken last year, but it did not materialize. There is still a distinct possibility that the law may be amended before it again reaches the legislature. Oil men hope that its terms will be less restrictive. Other legislation during the year included the authorization for construction of additional products pipe lines to complete the system from Puerto Berrio to La Dorada and from La Dorada to Cartago and Bogota itself. The building of these additional links would make it possible for the Bogota area to be supplied with products entirely independently of water transportation. The Magdalena River, over which all products are now moved, furnishes a very uncertain means of transportation during the dry periods.

Government Oil Company

The Minister of Petroleum, Dr. A. Aragón-Quintero, the five members of the National Petroleum Council, and various cabinet members, senators and congressmen were formed into a 17-member government-congressional committee to draft a bill which was enacted by Congress as the DeMares enterprise law. There has been set up a government oil company constituted to engage in all phases of the oil industry, and provision has been made for participation by both government and private capital. The company will take over the operation or other disposition of all concessions upon reversion to the government. The most important of these would be the DeMares concession which becomes the property of the government in August, 1951. There is still some discussion as to just what might be done at that time. It is possible that the national authorities may make arrangements with a private company on a cooperative basis, or it may take over completely for all phases of operation.

Surveys are now in progress on estimates of remaining reserves on the concession, together with studies of the possibilities of instituting secondary recovery operations. David Donoghue, consulting geologist of Fort Worth, and Prof. George A. Fancher of the University of Texas have been working on these studies for a number of months.

The outlook for expanded operations in Colombia is none too bright at this time in the absence of any new machinery for processing and approving concession applications, and for speedily establishing the validity of private titles. Delays in this respect, coupled with the growing tendency to increase the cost of exploration, and the hostile attitude of labor, have done much to lessen the interest of foreign operators.

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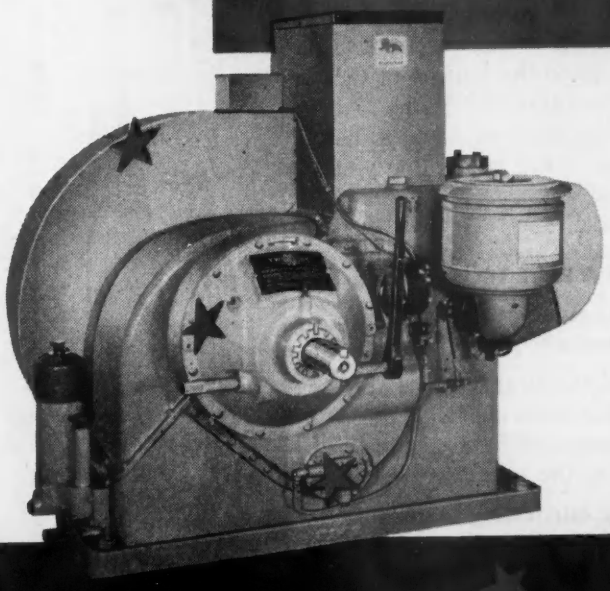

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It pays to centralize!

...the BAKER way

ONLY through the effective centering of your casing in the open hole can you obtain a sufficiently uniform annular cementing space to permit distribution of the cement slurry completely around the casing. Under this condition the hazard of channeling is minimized and the success of the installation is ensured.

FOR INSTANCE

Even in cementing a fence post in a post hole, you make sure that it is centered before you pour your concrete. You place the concrete all around the post. And you know you are doing a good job because you can see what you are doing throughout the entire operation.

BUT YOU CAN'T SEE DOWN AN OIL WELL!

And since you can't *see* that your casing is properly positioned in the open hole, you can only TRUST to the effectiveness of the centeralizers you have mounted on your casing.

HOW CAN YOU BE SURE?

The point is, how can you have a justifiable confidence that the centralizers you are using are actually *delivering* to the bottom of the hole all of the centering force they appeared to have when you admired them on the rack?

APPEARANCES CAN BE DECEIVING

You don't judge a racing car on the floor of a display room. It may look sleek and powerful there, all right, but that isn't enough to convince you to place your bets on it. No, you judge a racing car during a race–during every lap of the race, but especially during the final, grueling sprint to the finish line.

You can't judge a casing centralizer on the derrick floor. It may look rugged and potentially effective there. But that's not where you center your casing. You judge a centralizer by its ability to deliver effective centering force to the bottom of the hole where its job must be done. At least, that's the way you'd *like* to be able to judge it. The rub is that you can't see what's going on at the bottom of the hole.

BUT THERE IS A WAY TO KNOW . . .

Yes, there is the Baker way – the scientific approach.

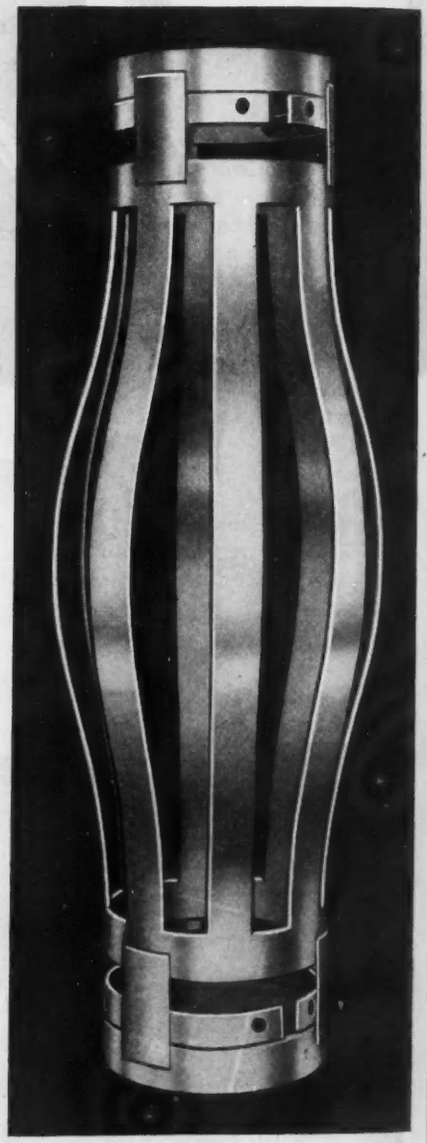
The test of a centralizer is its ability to exert maximum centering force AFTER the repeated flattening of its springs during the trip down-hole.

That's why our testing laboratory here at Baker has been kept in constant use during the design, development, and actual proving of our centralizer. Comprehensive tests, simulating every conceivable hole condition to which a centralizer is subject, were performed by Baker engineers in arriving at the unique design of the Baker Model "G" Casing Centralizer–*The* truly scientifically designed spring-type centralizer. During the course of these tests, every type of spring-type centralizer design was studied. The exclusive Baker Model "G" design proved convincingly to be the optimum.

YOU CAN DEPEND UPON A BAKER CENTRALIZER

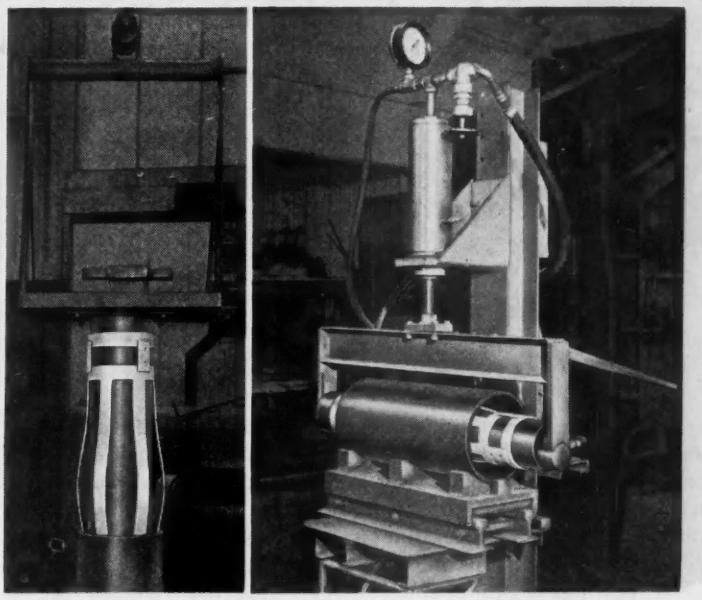
When you run a Baker Model "G" Casing Centralizer you can rest assured that it will do a proper centering job. As an operator, you need no longer worry about trial-and-error centering of your casing, because a Baker centralizer is a proven centralizer. Because of its design, the Baker Model "G" Casing Centralizer offers many exclusive advantages as well as desirable features.

1. It exerts maximum centering force where it is needed–not as the centralizer first enters the well bore or above the first well constriction, but after even the most rugged trip to the bottom of the hole where its actual centering job must be done.



Baker Model "G" Casing Centralizer, Product No. 910-G

2. Its springs are designed on the basis of maximum spring centralizing efficiency alone. The development of its unique mounting design has eliminated the need for sacrificing this ideal spring design to accommodate other factors that complicate previously accepted centralizer designs.
3. Its springs are *never* forced to deflect over the sharp edge of a ring or collar, since they are *butt-welded* (not lap-welded or riveted) to the Spring Collars, and the Stop Rings are positioned safely *outside* of the spring assembly area. Thus the casing supports the total centering force by direct contact with the springs.
4. As its springs deflect, their active length decreases. They are thereby stiffened and their centralizing action is increased.
5. All of its springs are compressed simultaneously as a unit and cannot be deflected individually.
6. Its mounting design permits rotation of the casing even under the most adverse conditions, and within annular clearances smaller than can be approached by any other centralizer.
7. It is, in effect, scientifically "tailor-made" to produce optimum characteristics for each individual casing range.
8. It starts easily and the Baker "tailor-made" feature eliminates the need for snubbing.
9. It is easy to install on the pipe. No on-the-job sizing or adjusting is required. Everything is pre-positioned so that the unit may be merely slipped on the casing and welded in place.
10. It is so designed that it is always PULLED (never pushed) by the casing on which it is mounted. This averts the danger of distorting or otherwise damaging the springs while raising or lowering the casing string past restrictions in the hole.



LEFT: Testing to determine the maximum bowed height and number of springs that can be incorporated into a centralizer and still permit easy starting of the first few joints of casing without "snubbing." RIGHT: With this testing device, the centering capacity of a centralizer at the surface is first determined by measuring the force required to flatten its springs. The effective centering capacity of the centralizer in open-hole position is determined in the same manner, but after repeated compression of the springs to simulate rugged down-hole travel.

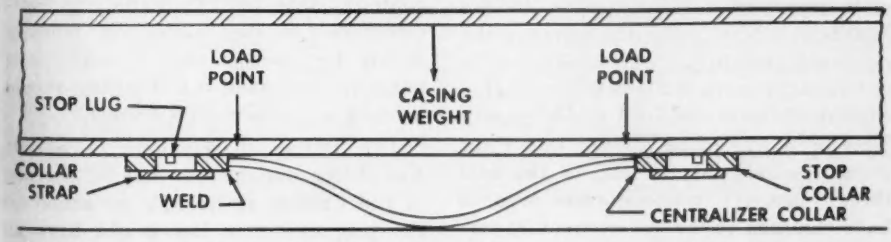


FIGURE 1. — Here is the ideal in spring design and mounting, found only in the Baker Model "G" Casing Centralizer. Note how the load point is imposed directly upon the casing; and how the properly "contoured" spring is free to move along the smooth surface of the casing as it deflects under compression. There is no chance for concentration of stress to cause a permanent set or breaking of the spring.

All of these features contribute to the fact that the Baker Model "G" Casing Centralizer yields greater centering force than any other spring-type casing centralizer within desired annular clearance ranges AT THE BOTTOM OF THE HOLE, where the actual job is to be done.

NEW BROCHURE AVAILABLE

A new, 16-page brochure, containing detailed information is now ready for distribution. Any Baker representative or office will be glad to furnish you with a copy upon request.

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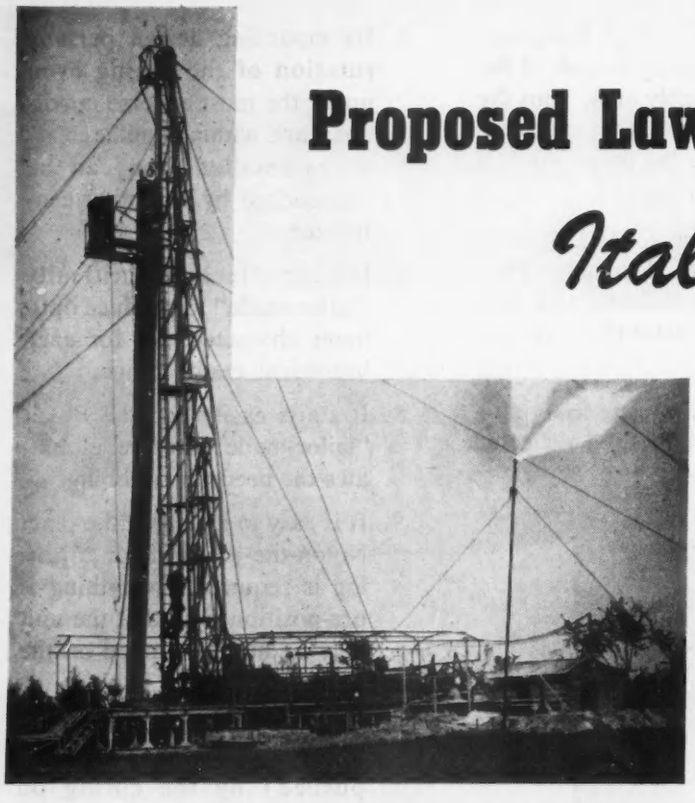
Get Maximum Centering Force with BAKER MODEL "G" CASING CENTRALIZERS

Proposed Law Would Stimulate *Italian Exploration*



New gas well goes on production in the Montalbano field, near the Po River delta. Societa Petrolifera Italiana, an Italian affiliate of Standard Oil Company (N. J.) used a modern light weight power rig for this well.

ALTHOUGH a number of foreign and domestic operators are interested in the possible development of additional oil and gas resources in Italy, one of the chief drawbacks is the uncertainty as to the disposition by the state of any properties upon which important oil or gas discoveries might be made.

The mining law now in force is the same statute adopted in 1927 by the Fascist government, which sought to place all resources under the direct jurisdiction of the state. Apparently there is nothing in the law to prevent carrying on exploratory work by private companies, either domestic or foreign, but neither is there a guarantee that the operator will be allowed to retain and exploit any oil or gas found. The law does not preclude the possibility of granting permits to private operators, and many private operators are allowed to operate their finds, but the government reserves the right to undertake the development of the discovered resources, or to turn them over to any other operating concern without necessarily allowing the discoverer to participate.

Since 1946 there have been vigorous efforts on the part of private concerns to convince the authorities that it will be impossible to achieve the most efficient exploration and development of oil and gas fields with such provisions remaining in the mining law. The Societa Petrolifera Italiana, a company in which a substantial interest is held by a subsidiary of Standard Oil Company (N.J.), has been taking an active interest in the possibility of obtaining new legislation with guarantees for freedom of operation and participation in production.

Relief Proposed

After much discussion the Ministry for Industry and Commerce, through its Office of Liquid Fuel, adopted a draft of a new law for submission to the legislative body. Under the terms of the proposed statute, a concessionaire was to have nine years in which to thoroughly explore the area obtained under permit. This term was to be divided into three 3-year periods. At the end of the first three years the concessionaire was to have returned to the government 30 percent of the original property; another 30 percent was to be returned at the end of six years, and at the expiration of the nine years he would be allowed to keep a selection of acreage amounting to no more than 28 percent of the original area. This was to be operated under an exploitation agreement lasting 30 years with option of renewal for another 20 years. Government royalty was to amount to 8 percent of the discovered oil, or its equivalent in cash at current market prices.

Considerable hope was held for the adoption of the new law when the Superior Mining Committee in Rome gave its approval and referred it to the Italian Cabinet. However on April 22, 1949, the Cabinet refused to submit it for the approval of the Parliament and Senate and has referred the draft to the Italian Committee for Reconstruction for further examination. This is said to have been done at the instigation of the Azienda Generale Italiana Petroli (AGIP), a state-owned company which contends that all exploration and development of the Italian oil industry should be placed under a single state concern; and that the industry should become a government monopoly.

The Italian shareholders of Societa Petrolifera Italiana fear that the decision of the Cabinet in holding up action on the proposed new law might have an adverse effect on the industry, and adopted a resolution at the close of a recent stockholders meeting for submission to the government. The resolution pointed out the dangers to continued development of the tendency to establish a preference for state organizations, which they indicated had not shown themselves appropriately organized to carry out such a program. It also pointed out the certainty that the various oil interests would refuse to devote their

■ CONTINUED ON PAGE 230

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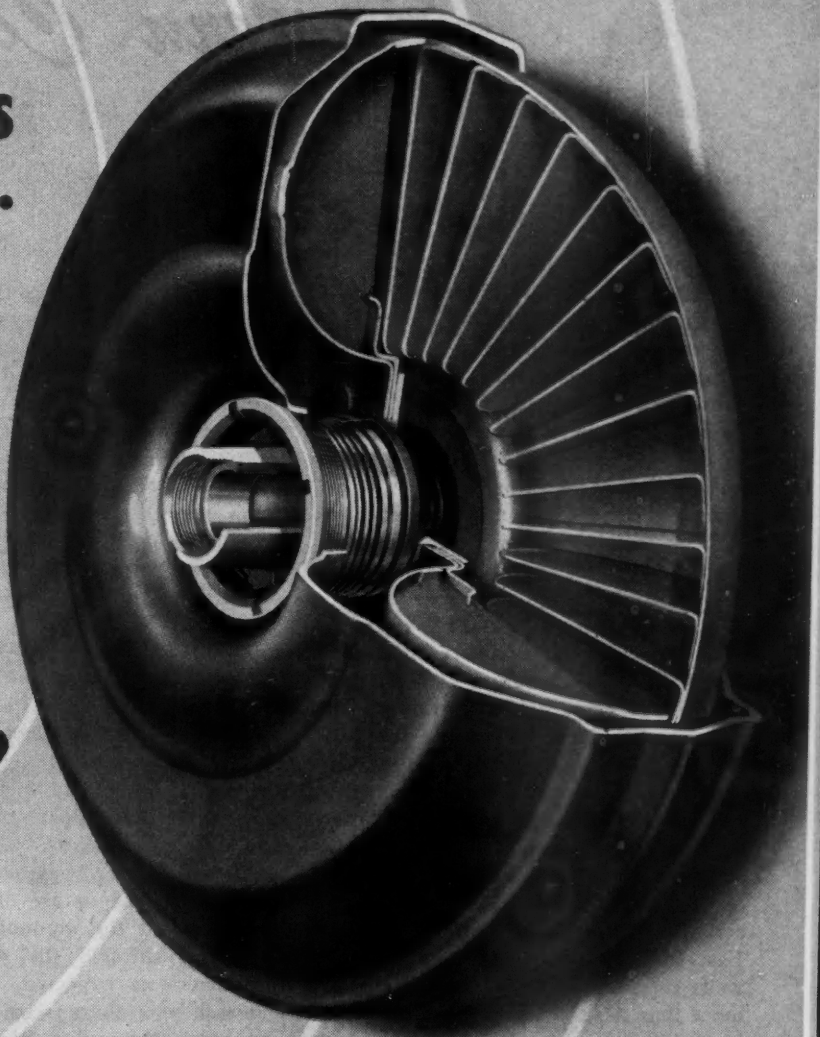
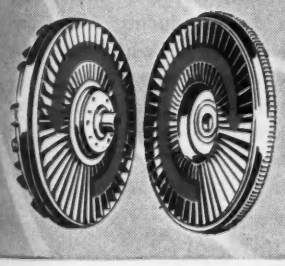
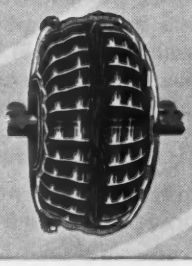
Actually only slightly more than the conventional flywheel which it replaces.





Driver and Runner flywheels are shaped like shallow bowls fitted inside with fins. They operate as separate units, with no mechanical connection—no metal-to-metal contact.



As the Driver turns inside the sealed steel drum, the confined oil produces a powerful swirling out-thrust. Instantly, the Runner receives the impulsion and transmits smooth power to the load.

The coupling is an integral unit. No adjustments are necessary. Oil maintains required fluidity over a wide temperature range. Remains unaffected by seasonal temperature changes.

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PROVED on thousands of industrial jobs—scores of applications under rugged field conditions.

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Development in West Obscures

Eastern Canada Activity

THE sensational development of Western Canada, particularly the province of Alberta, as an important oil region within the past two years has obscured somewhat the steady activity being carried on in the Eastern Canadian province of Ontario. The attention is deserved, since Alberta has proved the existence of hundreds of millions of barrels of new reserve within the past two years, has proved that these reserves can be readily converted into production at rates important to Canada's economy.

At the same time it has been pointed out that the continuation of activity in Ontario is remarkable considering its age as a producing area, and the relatively small return from the funds invested in development and in exploratory work. During 1948, almost as many wells were drilled in Eastern Canada as in Western Canada, although the type of drilling is indicated by figures for actual footage. These show that while Eastern Canada operators completed 392 wells representing a footage of slightly more than 424,000 feet, or less than 1100 feet per well, the 426 wells drilled in Western Canada accounted for a total of 1,801,570 feet of hole, or more than 4200 feet per well.

Southwestern Ontario was the scene of Canada's first oil production, only a few years after the Drake discovery in the U. S. Its output has never been extensive, but it has enjoyed a considerable amount of steady development work. The fields found in the area were moderate in size and productivity, and through their history have accounted for a total of more than 39½ million barrels of oil. Currently the over-all production average is less than a barrel a well, although wells in the newer areas produce at rates up to 50 barrels daily.

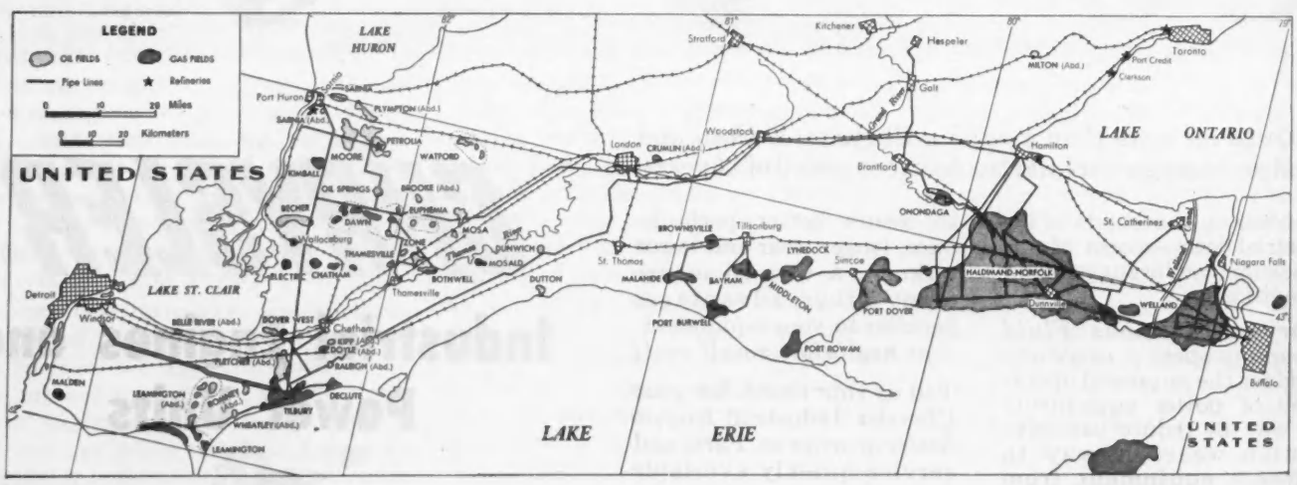
Active Drilling

Most remarkable, considering the fact that Eastern Canada has been producing oil since 1862, is the amount of exploratory drilling still taking place. During the past year 69 such wells were drilled and five were productive. Imperial Oil, Ltd., leads the search with more than a dozen drilling rigs under contract. Considering the nature of the geologic province and the amount of prospecting done through the years, nothing spectacular is expected, but the companies believe there is still oil to be discovered in the region. Some attention is being paid to areas in New Burnswick, the Gaspe Peninsula, and the St. Lawrence Lowlands, but most of the activity is concentrated in Ontario at the present time. Of the outlying areas, three wildcats were drilled last year on Gaspe Peninsula, three in New Burnswick and one in the St. Lawrence area.

The widespread exploration and development program being carried out by Imperial was rated as moderately successful during the past year, resulting in an increase of 33 percent in production. Total output for 1948 in Eastern Canada amounted to slightly more than 198,000 barrels, with a substantial portion of the increase due to the development of the Becher field near Wallaceburg where Imperial has drilled more than 30 wells. Of these, 13 were oil wells with a daily production of 175 barrels, six were gas wells with a net open flow potential of 4 million cubic feet daily, and the remainder were dry. The field was discovered in 1947 but had most of its development in 1948.

Early in the year Imperial opened a small producing area at Dante, near Bothwell where its discovery well produced 45 barrels daily from a total depth of 345 feet. One other producer has been completed and drilling is still going on.

The Kimball gas field, in which the first well was drilled during 1947, has seven wells now, all of which are gas producers and which together have a potential of nearly 7 million cubic feet daily. It was well defined on the south-



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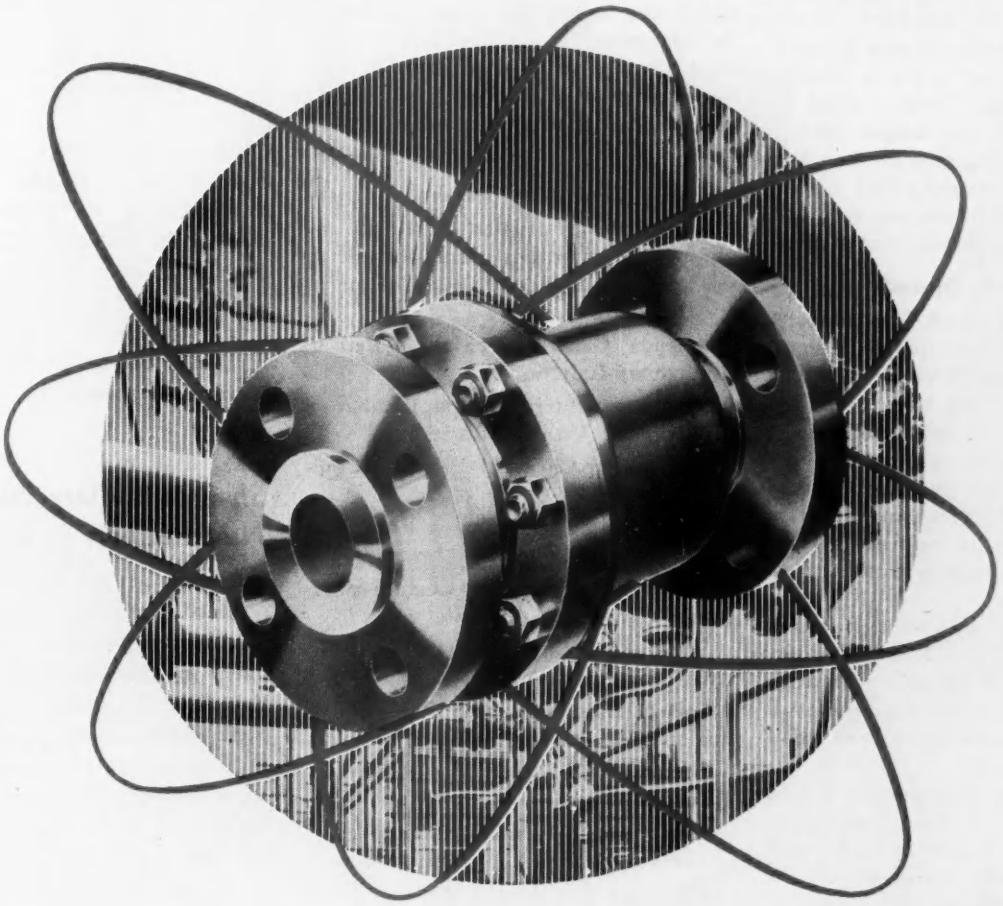

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west by the drilling during the past year, and the productive area may be more than 1000 acres. No oil production has been proved to date, but good showings of oil have been found in some wells. Production is from the Salina, found at fairly shallow depths.

In January, 1948, some encouragement was gained through discovery of the Staples field in eastern Essex County, where the initial well came in making about 150 barrels daily from a depth of 1250 feet. However, the output quickly declined to only a fraction of that, and subsequent wells have not added a great deal of value. One other oil well and two gas wells have since been drilled.

Gas Fields Opened

Imperial Oil and Union Gas Company opened a gas field about five miles south of Wallaceburg in the Electric area. The results of development have been disappointing, since four wells drilled since the discovery were all dry, but the area was of interest since production came from a depth of 4000 feet, in Cambrian formations below the horizons from which most of Ontario's production comes.

Another gas field has been opened in Essex County in the New Wheatley area, northwest of the old Wheatley pool, although it has not yet been evaluated since no wells have been completed since discovery.

The Union Gas Company which is quite active in exploration, having six drilling rigs in operation, opened a new gas area at Mosald, northeast of the Bothwell oil field during 1948, and completed seven gas wells for an open flow potential of 4½ million cubic feet daily. Many independent individuals and small firms are drilling in areas throughout southwestern Ontario, but for the most part their drilling is being done in the older fields.

Of particular interest recently has been a revival of prospecting on Manitoulin Island. Several favorable showings of oil and gas were found in this area several years ago but it has been idle until the past year, when Ashland Oil and Refining Company started drilling. Five wells were drilled in 1948, all of which are reported to have had showings of oil, although none were completed as commercial producers. Recently the company indicated it was planning a deep test. The other wells were all relatively shallow, averaging less than 1000 feet each.

The Salina-Guelph formations, of Silurian age, are the principal objectives in almost all of Ontario's drilling operations, although oil and gas have been found in the Devonian and Ordovician as well. The current interest remains steady in spite of the fact that the pools are mostly shallow and moderate in importance. The Becher field is the best of the recent discoveries, and operators feel that opening of other similar areas will justify the relatively small expenditure required for the shallow drilling. Actually the drilling of wells has proved to be the only practical method of prospecting here, since it is a very difficult area in which to work out surface geology. The region is blanketed by a glacial drift which obscures outcrops, and structure in the producing formations is seldom reflected at the surface. Despite the length of time since the first discovery of oil, it is estimated that more than three-quarters of the possible favorable area remains untested by drilling. As exploratory drilling proceeds valuable stratigraphic information is being obtained from the well records, and subsurface geology is playing an increasingly important part in exploration.

Proposed Law Would Stimulate Italian Exploration

■ CONTINUED FROM PAGE 226

energies and experience, including also the expenditure of large sums of money, to a search for petroleum resources in which they would not share. It invited the government to consider carefully the draft already accepted by the Superior Mining Committee before approving suggestions to establish the industry as a monopoly.

Concession Seekers

Among the companies which had applied for exploration concessions from the Ministry for Industry and Commerce are the following:

Azienda Generale Italiana Petroli, throughout Italy.

Societa Petrolifera Italiana, Lombardy, Emilian and Venitian districts.

Montecatini Chemical Products Company, Po Valley.

Edison Electric Company, Po Valley.

Societa Italiana Ricerche Coltivazioni Idrocarburi, Rovigo and Ferrara provinces.

Societa Idrocarburi Nazionali, Florence, Bologna and Forli districts.

Societa Italo-Americana Ricerca Produzione, Idrocarburi, Abruzzi districts.

Societa Italo-Americana del Metano, Polesine district.

Snia Viscosa, Venitian districts.

Lanificio Marzotto, Vicenza district.

McMillan Petroleum Company, Sicily.

Should the Italian cabinet refuse to approve the new mining law, all of these concerns with the exception of the AGIP will be affected.

Although the companies have continued operations since the close of the war in hope of finding some substantial quantities of crude, the greater part of what success has been enjoyed has been in the development of the substantial gas reverses of the Po Valley, and in setting up a network of pipe lines to make the gas available to most of the principal cities of Northern Italy. During 1948 a new gas field was found at Cortemaggiore, southeast of Piacenza and northwest of Parma, and early this year it was reported that a well on the northeast side of the field found oil in commercial quantities.

Shell Subsidiary Builds New Refinery in Italy

A member of the Shell Group has received permission from the Italian authorities for construction of another refinery in Italy. The Industria Nazionale Petroli e Trasformaziche (INPET), a Shell subsidiary, applied to the committee for supervising the Italian petroleum industry for a permit to build a refinery at Massa Carrara. This project provides for the construction of a plant in the industrial zone of Massa Carrara to process some 14 million barrels of Middle East crude annually in addition to 1,680,000 barrels of asphaltic crude of the Lagunillas type for the production of bitumen and lubricants. The new refinery would be connected by pipe line to the port of La Spezia. Shell already operates a refinery at La Spezia.

Socony-Vacuum Oil Company's refinery at Naples is being enlarged and it has been decided to use ERP funds to enlarge the oil dock there. At Palermo a new refinery is being planned by Azienda Generale Italiana Petroli which will produce principally marine fuels such as diesel oil and boiler fuel. This plant is to have a throughput capacity of 7500 barrels daily.

Two refineries at Leghorn and Bari, owned by the new Italo-American Esso-Anic company, each of which now processes 3½ million barrels of crude oil a year, are to have capacities increased to 10½ and 14 million barrels respectively. In addition equipment will be installed to produce fatty acids, ethylene, propylene, butylene and isobutylene.

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Western Hemisphere and Middle East Compete for European Oil Market

MIDDLE East crude is now available in sufficient quantity to satisfy all of Europe's current petroleum requirements, and consequently a wholly new turn has been given the worldwide movement of oil. Western Hemisphere crude is still flowing into Europe but the volume is decreasing, and in the early part of this year, at least, was counterbalanced by larger Middle East shipments into the Western Hemisphere.

This unexpected situation has been caused by two factors: stepped-up Middle East production and a downward re-appraisal of the petroleum requirements of practically all European nations. For 1948, Middle East production increased to a daily average of around 1.1 million barrels, up 34 percent over 1947. And at the same time the Economic Cooperation Administration has been trimming by as much as 15 percent previous estimates of Europe's oil needs.

Walter J. Levy, chief of ECA's petroleum branch, reports:

"ECA will soon enter its second full year, fiscal 1950. During that year European oil consumption is expected to go up only slightly, from 45.9 million tons (340 million barrels) in fiscal 1949 to 48.7 million tons (360 million barrels) in fiscal 1950. Imports will rise correspondingly from about 48.7 million tons to about 52.7 million tons (390 million barrels). The increase in European consumption, therefore, is expected to flatten out compared with the large increases from 1946 to 1947 and from 1947 to 1948."

A recent worldwide survey made by the Standard Oil Company (N. J.) Economics department indicates for the European countries a 6 percent rate of increase compounded over the period 1948-52, as against a 3½ to 4½ percent rate of increase for the U. S. for the same time. The Jersey economists predict that the Eastern and Western Hemispheres will become "autonomous" by 1952. Specifically, the experts see demand increases of 500,000 barrels a day additional gasoline abroad by 1952 over 1948; 600,000 barrels a day of light oils, and 300,000 barrels a day of heavy oils as the increase for the same period.

This pattern would reverse the consumption pattern prevailing in the U. S. While residual oils are expected to show the greatest rate of increase abroad, they are expected to show the smallest rate of increase domestically; while light oils, accounting for the smallest increase abroad, are expected to be the chief component in the increased consumption rate in the U. S.

Estimate for 1950

The Office of European Economic Cooperation, in a survey wholly separate from ECA's, has estimated that the Marshall Plan countries will use 49.7 million tons of products in fiscal 1950, a figure submitted several months ago and now 1 million tons higher than ECA estimates.

Three countries—the United Kingdom, France and Italy—will account for about 65 percent of total estimated consumption in Europe during 1950.

The accompanying table has been prepared by ECA oil experts to cover estimates of European petroleum consumption in 1950 as compared with previous years.

(All figures in thousands of metric tons)

	Fiscal 1950	Fiscal 1947	Calendar 1947	Pre-War
I. Transport	17,902	16,782	14,191	14,911
A. Roads	10,273	9,581	9,206	10,066
1. Commercial Vehicle	7,135	6,862	6,426	5,337
2. Private Car	3,138	2,719	2,780	4,729
B. Rail	1,468	1,359	646	63
C. Inland Waterway	988	897	640	486
D. Sea Vessels	5,173	4,945	3,699	4,296
II. Agriculture	2,414	2,131	1,763	672
III. Domestic and Commercial Heating and Lighting	3,209	2,710	2,565	1,705
IV. Industrial	13,394	12,677	9,875	4,092
V. Other Uses	2,109	2,693	2,075	1,015
	39,028	36,993	30,469	22,395

The table shows that the largest percentage of increase in the use of oil by the European countries will be in agriculture, a rise from 3 to 6 percent. ECA warns that even though Europe's total oil consumption can be expected to increase by 65 percent from prewar levels to fiscal 1950, and by another 26 percent from 1950 to 1953, Europe still will remain essentially a coal economy. During the prewar years coal supplied 85 percent of Europe's total energy and oil only 9 percent, with hydroelectric sources a close third with 6 percent. By 1953 the ratios are expected to be coal, 78 percent; oil, 12 percent; hydroelectric, 10 percent. Even by 1953 Europe will use only one-ninth of the amount of petroleum which the U. S. is using currently.

A number of factors explain the comparatively slow increase of oil consumption in Europe. The lack of better-type motor cars heavily cuts the increased rate of use of gasoline: and oil-burning equipment is still sparse all over the Continent. Petroleum prices are high compared with U. S. prices, and in certain countries products are still rationed to the consumer.

There is another changing pattern to European oil requirements: one-half of Europe's estimated oil imports in fiscal 1950 will consist of crude, compared with 41 percent this year, and 36 percent of a much smaller total in 1938.

ECA adds: "Dollar oil imports in 1950 are estimated at 21.8 million tons, or 41.3 percent of total imports into Europe; a figure which is close to the prewar level of 41 percent, and considerably below the 1947 share of 48 percent and slightly below the fiscal 1949 figure of 42.2 percent. In spite of the recent declining percentages of total imports, however, the absolute quantity of dollar oil imports has shown a year-by-year increase. Because of the larger crude component in the total, the value of all dollar oil imports in fiscal 1950, on the basis of November, 1948, prices, has been estimated at $562.5 million, compared with $594.2 million in fiscal 1949."

SEARCHING FOR BURIED TREASURE...

Flying Magnetometer speeds hunt for new oil, mineral resources in Africa

Long thought a treasure house of oil and mineral resources, Africa's new exploration and development flies ahead today with giant aerial strides. To speed industrial reconnaissance of the Dark Continent's great areas, American oil and mining interests rely on two precise mapping tools—the aerial camera and the newly developed airborne magnetometer.

Now the mapping plane explores *anywhere*, from the treacherous Canadian muskeg to the tsetse-ridden African jungle. In South Africa for example, the survey plane maps over terrain so rugged that ground parties would need months to cover the area flown in a single day. In Mozambique, the wild elephant herds, fierce rhinos and lions, as well as malaria and sleeping sickness, make ground surveys both slow and hazardous. *At a fraction of the cost of ground work*, the aerial survey collects engineering and geologic facts. And the airborne magnetometer probes the earth's crust for magnetic data—important guideposts for oil and mining geologists.

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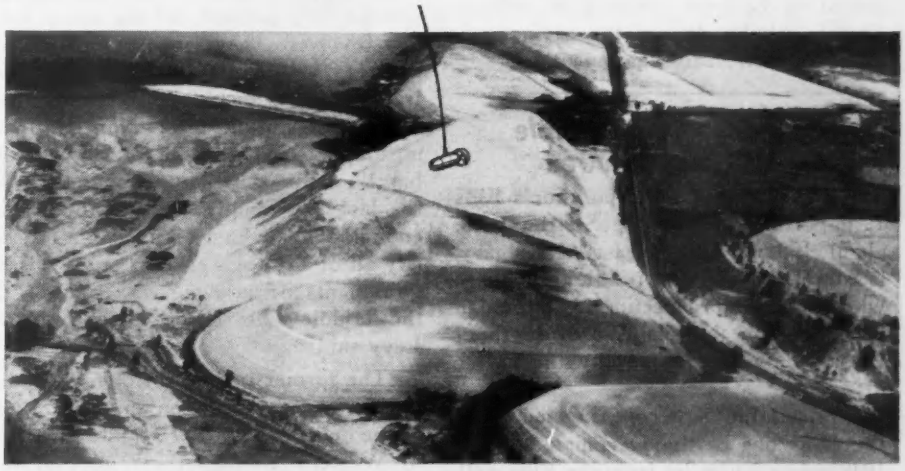

In the Union of South Africa, the airborne magnetometer flies over waste sludge piles of the gold mines. These tailings, sometimes as high as 200 feet of oozing mass, rarely solidify.

Barefooted, uneducated but friendly, these natives are their own beasts of burden.

Thorough pre-flight check of the high sensitivity airborne magnetometer.

Fierce elephant herds and other wild life are found within only 40 miles of Lourenco Marques, Mozambique's "Miami Beach."

Trek wagon and oxen, a typical South African trucking facility, bring gas to refuel the survey plane.

Minimun ECA Funds Will Buy Petroleum Tools for Europe

ECA, seeking to lessen the competitive impact on the American oil industry of the huge petroleum program that is a part of the European economic recovery effort, has announced that during its first year of business "it has authorized almost no expenditures for petroleum equipment." Despite the fact that the equipment program has been held to a virtual standstill, ECA authorized the expenditure by the 16 European countries of $460 million for crude oil and petroleum products plus another $130 million for tanker transportation.

Total original projected cost of the petroleum program under ECA was put at about $1 billion for the first 15 months of operation. However, on the basis of the first year of work, the budget is expected to be held under $750 million. This is wholly due to the savings effected on petroleum equipment.

Walter J. Levy, chief of ECA's petroleum branch, says that the agency has tried to operate as much as possible through private channels of trade, "and also we have tried to avoid any harmful impact on the domestic economy."

"We have always fully appreciated," Levy said, "that it is the private industry of the U. S. operating under a free enterprise system which is producing and supplying the goods which Europe needs; that private industry is entitled to arrange its affairs in line with normal economic, competitive and commercial considerations; and that the government has a right to interfere in such operations only on the basis of a specific law or of overall principles."

In ECA's study of Middle East crude prices, Levy pointed out the many factors involved: heavy investments of the industry abroad, risks incurred, and transportation distances. He cited the Middle East crude production rise during 1948 to an average of 1.1 million barrels daily, or 34 percent over 1947. In the last few months of 1948 there was enough Middle East oil available to satisfy all of Europe's current crude oil requirements. In arriving at a solution of the Middle East crude price problem, Levy said:

"The former realized price for Middle East crude was based on an equalization of the delivered price of Middle East and of Western Hemisphere crudes in the importing countries of Western Europe. The basic facts of supply and demand supported such a price level because Western Europe at that time was dependent on these two sources of supply. However, in view of increased availability of Middle East crude since 1948, Europe is in the process of becoming independent of Western Hemisphere crude. Middle East crude, therefore, in due time will find its own price level for shipments to Europe."

Levy cited figures to show the importance of this for ECA's program: "Currently estimated crude oil imports from dollar sources in the Middle East into Europe during fiscal 1950 would have cost, at the prices prevailing last April, about $20 million more than they will cost at prices expected to prevail during the year. If we were to finance purchases of Middle East crude at prices permitted under the law, the estimated cost of Middle East crude imports from dollar sources into Europe during 1950 would be approximately $35 million more than we expect it to be."

Europe is trying to reduce dollar expenditures for oil in two ways: by building up refining capacity and by stepping up crude production. Commenting on this, Levy said: It is obvious that the dollar shortage of importing countries introduces a new and very disquieting competitive element in the international oil trade which may over-ride in importance considerations of price, quality, trade relationships and historical trade patterns."

American companies, he said, should maintain a substantial stake in Europe's oil business, and "it should be possible to assure that American-owned refineries in Europe will continue to serve as outlets for crude oil produced by American companies. It should also be possible in certain well-defined circumstances to assure American companies against unfair competition based on currency considerations. On the other hand, a healthy expansion of the European refining industry, which may mean fewer exports of finished products for American suppliers, appears to be desirable for Europe."

Without ECA, Levy argued, "the American oil business in Europe would already have been shot to pieces." Many European markets had exhausted their dollar resources a year ago, so the British "would have had to build up their oil industry with the greatest possible speed to furnish an alternative source of supply."

Devonian Discovery Possible In Canada's Stettler Area

Canadian Gulf Oil Corporation's Ellis 1, important test in the Stettler area, about 100 miles northeast of Calgary, is strengthening the position of those who have been prospecting for Devonian production in the Plains area south of the region made famous by the Leduc discovery.

Although the same company had found the D-3 zone of the Devonian early in 1948 only a few miles from the Ellis well, the presence of oil in the D-2 zone here with the possibility that the D-3 may underlie it in the same well, gives increased hope for another major discovery. At 5240 feet the well penetrated 50 feet of D-2 pay and flowed at the rate of 20 barrels hourly during a drill-stem test. The well was allowed to flow through a one-half inch choke on drill stem for nine hours, making 30-32-gravity oil with a gas-oil ratio around 500 to 1. It will drill ahead to prospect the entire Devonian section.

Although a considerable amount of wildcatting has taken place in the general region, most wells have been drilled with the Cretaceous formations as principal objective and comparatively few have gone into the Devonian.

The well drilled last year penetrated 500 feet of D-3 Devonian in a coral reef structure believed to be the same feature on which the Ellis well is located, and should the lower formation be productive in this well there is little doubt that another major discovery will be recorded.

Negotiations Are Resumed Between Oil Company, Iran

Negotiations have now been resumed between the Iranian government and representatives of the Anglo-Iranian Oil Company, recently returned to Teheran. Sir William Fraser, chairman of the company, is expected to take part in the final discussions.

The Iranian government is about to inaugurate a seven-year plan of national development, which is one of the reasons they want more money from the company. It has also been a source of grievance that the Persian government shares in the profits from the oil industry by less than half the amount the British government receives in dividends and from taxation of the profits. The negotiations for new terms began in August of last year but were interrupted for three months while the company answered a questionnaire from the Iranians, were resumed in February, and were then interrupted by the Persian holidays.

The recent success of the Imperial Bank of Iran, whose 50-year concession expired on January 30, in negotiating an agreement under which it can continue to carry on business, encouraged hope that the government and the oil company will be able to come to terms.

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TAPline Contract Approved For Passage Through Syria

THE Syrian cabinet has unanimously approved the contract with Trans-Arabian Pipe Line Company, subsidiary of the Arabian American Oil Company, for passage of the line through Syria on its route from the producing fields of Saudi Arabia to the Eastern Mediterranean, according to official Syrian sources in Damascus. However, details of the ratification of the convention with the company have not been disclosed, and it is still doubtful how rapidly TAPline can proceed with actual construction of the line. Company officials say they now expect to have the line laid by the end of 1950.

Syrian approval followed days of wrangling in the cabinet and was the result of pressure by Premier-Dictator Husni Zayim, who took the position that the revenue which the line would bring Syria is needed for the completion of his stepped-up economic program for the country.

Preparatory work in Syria will get under way immediately, Zayim indicated, but it is admitted that actual construction will be delayed for months. Of the entire length of the projected 1040-mile line, only about 100 miles of it will cross Syria. However, approval by Zayim indicates that Syria has withdrawn its recent demands that the line terminate on the Syrian coast and agrees to the company plan for bringing the pipe out at Sidon, Lebanon.

The original cost of the trans-desert line was put at $125 million, but present estimates are around $200 million, and some sources say the line will total $300 million before it can be completed. Delays, political complications, and rising construction costs are held responsible.

One industry leader who has followed the company's long-snarled negotiations with the Syrian government points out that the mere signing of the convention for transit rights leaves unanswered a host of operating problems on which agreement must be reached before the line can become a reality. Surveys must be conducted and the whole cross-Syria section of the route must be approved by Zayim. In addition, intricate land right problems are involved, and issues centering on the importation into Syria of material and equipment for the line and labor arrangements are about to be raised.

Zayim is reported seeking to finance his ambitious "Syrian regeneration" program, chiefly through revenues derived from the line and from Iraq Petroleum Company's operations in Syria. Earlier, Zayim indicated that Syria demanded that the line terminate on the Syrian rather than the Lebanese coast, that higher transit fees be paid, and that TAPline assume other economic costs such as the improvement of the port of Latakia and expansion of rail and highway facilities to the port. Observers now feel that Zayim fears he has overplayed his hand and is tempering his demands so that TAPline officials do not decide to re-route the line so as to bypass Syria altogether.

American interests felt they were in a "squeeze" between the nationalist aspirations of Syria and Lebanon. Feeling between these two Arab countries is now tense because of conflicting interests. Lebanon is more than half Christian in population, and Syria is almost wholly Moslem; Lebanon has the most advantageous port locations of the Eastern Mediterranean, while Syria is seeking other outlets to the sea; Lebanon is more Western in its culture and desires stronger economic ties with the Americas and with Europe, while Syria is more Oriental and thinks in terms of its position in the Arab world.

In the light of the earlier demands by Syria, which would have included virtual underwriting of Syria's new economic program by the American oil interests, some uneasiness had been felt by observers as to whether or not it would be wise to take the line through Syria in any event. The Zayim regime came into power through its nationalist appeal to the street masses, and has given favorable reception to the popular demands of the Arab press which has been particularly bitter toward American oil firms.

New Producers Encourage Iraq Exploration Program

Considerable encouragement is being given to the exploratory campaign now in progress in southern Iraq. Two new producing structures have been found in recent months in the drainage area of the Upper Persian Gulf, both by the Basrah Petroleum Company Limited, a member of the Iraq Petroleum Company group. The general area west of Basrah has been covered rather extensively with various geophysical methods including seismograph, magnetometer and gravity meter work, and a number of possible structures have been located. Drilling has resulted in the discovery of a new field at Nar Umar where a wildcat showed a potential of 2500 barrels daily on a production test at total depth of 8360 feet. Previously a well 24 miles to the south at Zubair had found oil at 7775 feet, being completed for an initial production of 3500 barrels a day. The existence of oil in this well had been established a number of months ago, but it was carried deeper as a deep test to look at the lower formations. It reached a total depth of 11,171 feet before it was plugged back for completion at 7775 feet. Another wildcat is being drilled now at Ratawi, 30 miles west of the Zubair well, and is now below 7140 feet.

The search for oil is not being concentrated in the southern part of the country, since work is also going forward in northern and central Iraq. A well is now being drilled at Mushorah Dagh, northwest of Ain Zalah and near the Turkish frontier following stratigraphic studies made in northern Iraq. The Mushorah Dagh well is being drilled on a prospect outlined by preliminary work, and is primarily a test to determine the stratigraphic sequence of formations in this particular region.

Meanwhile a well drilled west of the Kirkuk field at Bai Hassan was completed as a high-volume gas well.

Although none of the Mosul region fields have been placed on production, the I.P.C. group has continued drilling in the Ain Zalah field in an effort to define the field and build up potential for the time it is provided with a pipe line outlet. Four wells were drilled there last year, two of which are producers and two dry holes, and two rigs are now operating in the field. The area is still considered in a semi-exploratory phase.

Iran Nullifies Bahrein Pacts Involving Foreign Powers

Nouri Esfandiari, foreign minister of Iran, announced that his government has decided to consider as null and void all pacts and understandings between two or more foreign powers concerning the Bahrein Islands in the Persian Gulf, or their oil. Abbas Eskandari, deputy for Manadan in the Majlis, and secretary of the parliamentary commission appointed to examine the status of the Bahrein Islands, is offering a reward of about $325,000 to anyone succeeding in restoring Bahrein to Iran and in solving problems connected with the Anglo-Iranian Oil Company.

The Majlis approved a bill presented by the government to engage three competent oil experts to advise the government on judicial, technical and economic problems, particularly in respect to Persian rights concerning the Anglo-Iranian Oil Company.

Ethiopian Operations Begin With Spudding of Gumburo 1

Sinclair Petroleum Company has spudded its first well in Ethiopia, as part of an intensive program to discover oil in as yet untested areas of the world. This well, Gumburo 1, is in the Gumburo Hills in Ogaden, 250 miles by air and 475 miles by road southeast of Dire Dawa. The cost of preliminary geological work and the importation and stocking of material and equipment has already reached several million dollars, and the company expects it may be compelled to spend another million completing the first well.

Work has been delayed by political disturbances in Ethiopia and by unanticipated difficulties in preparing the first test. One of these proved to be the unexpectedly hard job of finding water. Two water wells were drilled recently and one went to 500 feet before water was located.

A company personnel of 41 is now in Ethiopia, and virtually the entire field complement of 32 watched the spudding-in ceremonies in the wilds of the African kingdom. W. J. Wells, field superintendent, and Earl Traeger, chief geologist, stood on the platform of the 130-foot derrick as the drill began to turn.

Sinclair has constructed 26 houses at the camp, a mess hall, a recreation building, and a warehouse. In the sparsely settled regions of Ethiopia the company contingent is as large as a number of native tribes, with much more permanent installations than many Ethiopian towns.

Handicaps of moving in equipment have been tremendous. Much of the heavier material was sent by boat to Djibouti, French Somaliland port, and were there loaded on the Dire Dawa railroad for the 186-mile haul. At Deri Dawa equipment was transferred to truck and hauled 475 miles to the camp site. Some supplies were unloaded at the Indian Ocean port of Mogadishu and trucked north for 300 miles over fairly flat country.

Sinclair Petroleum Company, the operating agent, is a wholly-owned subsidiary of Sinclair Oil Corporation. Six years ago it obtained an exploration concession for all of Ethiopia. Extensive geological studies were carried on for three years, centering in the Ogaden area, a region about the size of Kansas. Drilling equipment and full complements of motorized equipment were shipped from the U. S. Considerable road building was required from the Dire Dawa headquarters to the camp site.

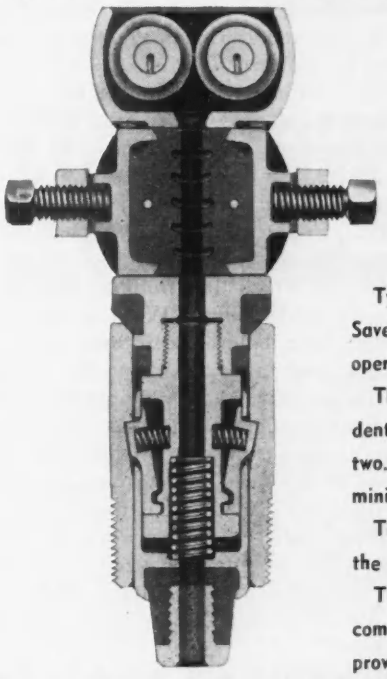
Early last year Sinclair's work was interrupted by tribal uprisings. Crews and equipment stood idle awaiting a settlement of the dispute which terminated only with the withdrawal of the British from Ethiopia. The low-lying, sun-baked Ogaden area of Ethiopia is populated by wandering Somali tribesmen who could not be curbed by the British police force.

Discovery of oil in Ethiopia would have a variety of significant consequences. It would revolutionize the prospects for the land-locked nation of Ethiopia, the economy of which is still on a hand-to-mouth basis. Also, abundant sources of oil on the African continent would make less strategic the vulnerable Middle East.

The Sinclair site is about 300 miles from the sea, and if oil is found a pipe line could be built, most readily through Italian Somaliland to the coast.

The company is prepared to go down 15,000 feet in its first Ethiopian test.

For Swabbing Operations



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Mexico May Modify Oil Laws To Attract Foreign Capital

THE first hint has been made by any responsible Mexican government official that Mexico may modify its basic petroleum laws for the greater attraction of foreign capital in the badly-needed development of Mexico's petroleum resources. That hint was given by the Mexican Ambassador to the U. S., Rafael de la Colina, in an address to the Advertising Club of New York last month. Colina promised very little, but he did suggest the legal modification to remove the biggest obstacle that now stands in the way of American capital and skills participating in the ambitious petroleum program announced by Petroleos Mexicanos (Pemex), Mexico's state oil monopoly.

Colina said: "Petroleos Mexicanos recently entered into agreement with several American companies in order to insure the realization of an extensive exploration program. No change in the law was needed to achieve this beneficial result. It has been insistently stated that the only practical way for undeveloped or partially developed countries to forge ahead is to attract private investment. I think there is much truth in this general proposition. But to change such laws as appear to obstruct the unrestricted flow of private capital is a most delicate question. The modification of such laws and regulations will naturally come when the countries are developed to a degree where they are able to resist undue attempts to trammel the free exercise of their sovereignty."

Colina added that "Wide-awake, fair-minded investors need not expect other than ordinary risks in Mexico."

Colina lauded the accomplishments of Pemex, saying that Mexico's crude production had risen from 47 million barrels in 1937, the year before expropriation, to nearly 60 million barrels in 1948. "Mexican refineries," he said, "processed in 1948 about 50 million barrels of crude as against 36 million in 1937. In 1937 about 80 percent of total output was exported, while today only 18 percent is exported and the remaining 82 percent is consumed by our rapidly expanding industries and our increasingly mechanized agriculture."

Mexico City is now for the first time using natural gas, Colina said, after the completion of a pipe line from the Poza Rica field, 150 miles away.

"It has been repeatedly asserted that in 1921, under private management, 193 million barrels of crude oil were produced, of which 188 million were exported," said Colina. "What is silenced is that long before expropriation, production had fallen to about 33 million barrels in 1932, and that notwithstanding the tremendous handicaps—including boycott—under which Pemex has labored, it has been able to increase production, modernize and expand refining facilities, add to its network of pipe lines, augment storage capacity, improve the marketing of its products and contribute to the economic development of Mexico."

Meanwhile Senator Antonio J. Bermudez, head of Pemex, waited around Washington for the long-expected but still delayed loan from the U. S. government to help finance Pemex operations. Opposition to the granting of a Mexican petroleum loan was mounting despite its favor by the House Interstate and Foreign Commerce Committee, and many observers predicted that no funds would be granted to Pemex. A compromise plan was advanced by which a line of credit would be extended Mexico but not earmarked for oil development.

One of the most forcible protests against an oil loan to Mexico was made to the National Petroleum Council at its quarterly meeting last month. E. E. Pyles, president of the San Joaquin Valley Oil Producers Association, told the Council that "the propriety of making such a loan at any time is questionable. But in view of the oversupply of crude oil and its products which we now have in this country, the making of such a loan at this time would be most unwise. The question of giving $200 million of the taxpayers' money to a foreign government to be used to the disadvantage of one of our largest domestic industries, appears to me to be a question of national importance." Pyles asked the council to refer the issue to Secretary of Interior Krug.

Refinery in Hamburg Area Bought by Anglo-Iranian

The Anglo-Iranian Oil Company has concluded negotiations for the purchase of one of the largest oil refineries in Germany. Located in the Hamburg area, the refinery has been known as the Europaeische Tanklager & Transport, A. G., and was formerly owned by Davies & Company, Inc., a U. S. firm.

Situated on the River Elbe, near the principal petroleum harbor of the Hamburg area, the plant suffered considerable damage under Allied air attack during the war, and its capacity early in 1948 was estimated at 3500 barrels daily.

GUESTS OF LOS ANGELES NOMADS—Foreign guests who attended the May meeting of Los Angeles Chapter of Nomads included, above left (standing), Paul Molidor, Standard Oil Company (N. J.), Colombia; J. R. Grove, Nathsingh Oil Company, Ltd., Burma; A. L. Owen, Iraq Petroleum Company, Kirkuk, Iraq; A. T. Gano, Creole Petroleum Corporation, Caracas, Venezuela; A. J. Dodini, Bahrein Petroleum Company, Ltd., Bahrein; (seated) C. H. Vincent, British Malahan Petroleum Company, Seria, Borneo; P. F. Owings, Iraq Petroleum, Kirkuk; G. H. Atkins, Creole, Caracas. At right are, standing, M. R. Teague and D. E. McGehee, Jersey Standard, Egypt; G. H. Patterson, Aramco, Dhahran, Arabia; John H. Lewis, Drilling & Exploration Company, Inc.; seated, Mike H. Bush, Richmond Exploration Company, Venezuela; J. S. Ramirez, American Overseas Petroleum Company; and R. B. (Bob) Loughboro, Aramco, Dhahran.

Imperial Orders Steel for Edmonton-to-Regina Line

Imperial Oil, Ltd., has placed orders for 67,000 tons of steel plate for fabrication into line pipe for the new trunk line system from Edmonton to Regina. The order, representing more than $9 million, was placed with Steel Company of Canada, Ltd., a firm which will make the steel to specification and roll it into plate. According to reports it is the largest single order ever received by Stelco. It represents about 10 percent of the company's yearly ingot capacity and will take about a year to deliver.

The plate will be fabricated into 16-inch pipe for a 457-mile pipe line from the prolific new oil-producing region of Southern and Central Alberta to transport crude to refining centers in Saskatchewan. Page - Hersey Tubes, Ltd., will convert the plate to pipe. The line is scheduled for completion by the end of 1950. Route surveys are already completed.

The new pipe line is the first step in Imperial's program for broadening the market for Alberta crude. The program calls for expenditure of $53 million during 1949, or more than twice the total earnings of the company in 1948. The line itself is vital to the future of Western Canada's oil, since production from the area has already reached the limit of available transportation. The consuming potential of the Prairie Provinces is about 65,000 barrels daily. Production is approaching that figure now, but no facilities exist which would permit the moving of additional crude into broader markets.

Manitoba Test Drills Deeper After Finding Oil Showings

The search for oil in Canada continues to attract interest as showings of oil are found in the Province of Manitoba. Souris Valley Oil Company's deep test in the southwest corner is drilling below 3000 feet, but has already reported showings of oil at 2161 feet in the Lower Cretaceous formations.

This wildcat is about 2½ miles from the village of Lyleton, just inside the International border and about nine miles east of the Saskatchewan border. Objective is the Pre-Cambrian, expected around 5500 feet, but the section which will be of most interest is the Devonian, the formation from which the important new production in Alberta is produced. The level at which the various Devonian horizons are found is expected at 4000 to perhaps 5000 feet. The area is being watched with interest by a number of the companies operating in Western Canada, some of which hold exploration permits in the vicinity of the well. Imperial Oil, Ltd., has around 30,000 acres of such permits; Standard Oil Company of California has some holdings; The Superior Oil Company of California holds 20,000 through its subsidiary Rio Bravo Oil Company.

Geophysical work has been done in the area for two years, and considerable interest is being aroused. The current will furnish valuable information on stratigraphic conditions.

Turkey Re-States Concession Policy With Foreign Firms

Rumors that American oil companies were trying to obtain concessions for exploitation of oil areas in Turkey have brought from the Turkish authorities an official statement to reaffirm its announced policy of not granting concessions to foreign operators. At the same time it was stated that there had been no requests from American firms for concessions.

The statement had been made as a result of press reports following the visit of one of the Middle East representatives of an American oil company who went to Ankara where he was received by the vice premier, Mihat Erim, and Minister of Commerce and Industry Djemil Barlas.

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Liberalization of Policy On Argentine Oil Indicated

PRESIDENT Peron of Argentina has indicated a possible softening in his attitude toward foreign petroleum operators. Last month the Argentine dictator addressed his congress and declared that Argentina will continue to "nationalize all public services." However, in the list of public services which he named, petroleum was omitted.

U. S. and British oil interests in Argentina have been especially fearful of the principle of compensation provided for in case of the expropriation of oil properties. The new Argentine constitution provides that the expropriation price should be the original investment minus all profits made during the company's existence in Argentina except for "a reasonable profit." As one oil official expressed it, "this means we would have to pay for the privilege of being expropriated."

Peron's nationalization program, as he laid it before the Argentine congress, gave considerable hope that oil would not be covered. Peron specifically mentioned transportation, electric power plants, telephones, telegraphs, and water systems as those which are facing nationalization, but made no mention of petroleum. Furthermore, he added that he did not intend to "take unfair advantage" of any business interest in the country.

Peron added that Argentina would resort to expropriation only when "owners refuse to accept reasonable solutions which we are always willing to propose."

Oil is critically short in Argentina. Recently Buenos Aires asked the British for 37 million barrels of petroleum, an amount which equals Argentina's annual import needs. U. S. companies in the past have furnished the bulk of Argentina's oil imports, but Peron is seeking to save dwindling dollar resources. The Argentine-British oil deal involved a trade of meat for oil on a price structure to be worked out mutually. Roberto Antonio Ares, Argentine Minister of Economy, said: "Britain needs meat more than it does sterling; we prefer steel and oil to blocked pounds."

Yacimientos Petroliferos Fiscales, the Argentine government-owned oil monopoly, plans to construct a 400-mile crude line from the Plaza Huincul field in west central Argentina to the seaport town of Bahia Blanca, 360 miles southwest of Buenos Aires. YPF also has signed a contract with M. W. Kellogg Company for construction of two complete refineries to be located at San Lorenzo and Lujan de Cuyo with a combined capacity of 28,500 barrels.

Aerial Survey Is Complete Of South Queensland Area

The aerial survey of the Roma Blocks permit in South Queensland, Australia, was completed in February and the photographs are being examined. However, it is understood that much of the geology of the area is masked by surface deposits and the information obtainable from the aerial photos will have to be augmented by a considerable amount of drilling.

The Lakes Oil Limited has said that an estimated 7000 to 10,000 gallons of oil and water have seeped into the bottom of the shaft from the horizontal holes drilled two years ago. This is being bailed pending the installation of a pump. It has been stated that horizontal drilling from the large shaft will be resumed before the end of May.

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Discovery of New Oil Field in Emsland Area Is Indicated

Discovery of a new oil field for the Emsland in Western Germany has been indicated in a well now being drilled by Wintershall A. G. The company's Ruehlertwist 2, northwest of the town of Lingen, has found porous saturated sandstone from 2255-85 feet, and at latest report was setting casing on top of the sand. It was to drill plug and core through the sand section before running a production test. No flow tests had been made, but core analysis and electric logging surveys indicated the well should produce in commercial quantities from sands already found.

The structure is in the same general area as the Georgsdorf and Emlichheim fields, and the pay formation is the Bentheimer sandstone found in both these fields. According to geological interpretations, the structure is a local high on the eastward extension of the same feature as that on which the Emlichheim and the Schoonebeek fields are located.

The wildcat was drilled on a concession owned jointly by the Wintershall, Gewerkschaft Elwerath, Preussag and C. Deilmann firms and operated by Wintershall.

A new producing field in Emsland bears out the prospects of more than a year ago regarding the increasing part played by Emsland fields in total production. The four fields of the Emsland . . . Emlichheim, Georgsdorf, Lingen and Adorf . . . have had an important part in bringing the total output for March to 446,200 barrels of oil, and production for the first three months of the year to 2,020,186 barrels, or about ½ million barrels more than was produced in the first quarter of 1948, and surpasses producing rates of the peak years of 1940 and 1941.

During March total drilling in all of Western Germany amounted to 78,700 feet, of which one-third was represented by exploratory drilling. This is a new high for drilling volume in Germany, being above the monthly average for the war years and almost double the prewar 1935-38 average.

Allied Oil Commission Set Up In German's Hamburg Area

At the suggestion of the Bipartite Control Office, the American and British authorities have appointed a commission of Allied oil men in the Hamburg area. Now at work this commission is authorized to work out recommendations for the future program of oil and product supplies to Western Germany. It is hoped the commission can be ready to present recommendations within a few weeks.

The group is composed of five members representing oil companies as well as the current control groups. Included are representatives of the Oil Branch, Fuel and Power Division, BICO Commerce and Industry Group, Anglo-Iranian Oil Company, Socony-Vacuum Oil Company and the Shell Group. The problems of the commission will be to work out the most economic and practical method of arranging the supply of petroleum products to all districts.

This is becoming a problem of some magnitude with the constantly increasing consumption in the Western zones. During 1948 more than 16½ million barrels of finished products were consumed in the Bizone, including the western sector of Berlin, an increase of 32 percent over consumption in 1947. The largest single item is diesel fuel, which comprises about 40 percent of all consumption. The problem of distribution becomes more acute with increases in refinery operation as more plants have been placed on stream and output of operating refineries has been boosted. During the second Marshall Plan year the imports of crude will be boosted materially with a reduction in the amount of refined products coming in from outside sources.

FOR THE BEST IN CABLE TOOLS

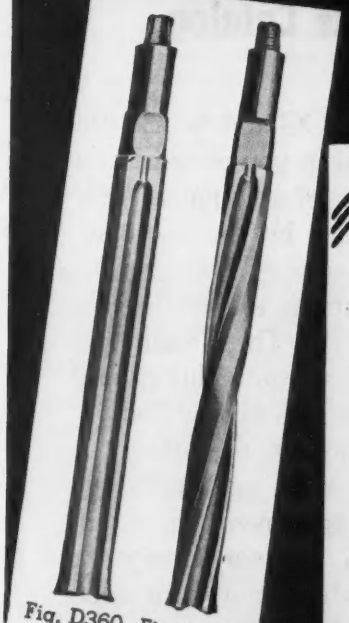

Fig. D360 Fig. D368

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135—Brake Blocks

This item supplements Gatke Corporation data as shown on page 1405 of Composite Catalog.

Developed to meet the requirements of flame hardened flanges, MW brake blocks are a combination of the two main types of asbestos friction materials integrally moulded into unified brake blocks. The frictional characteristics of woven asbestos and the long wearing qualities and high heat resistance of moulded asbestos materials are combined.

The blocks are non-compressible and the moulded backing provides secure anchorage, so that bolt heads do not pull out. Engineered for the application, the blocks are moulded to size and flange curvature.

For additional information write Gatke Corporation, 228 North La Salle Street, Chicago 1, *referring to* WORLD OIL *item* 135.

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Composite Catalog contains the catalogs of 462 leading manufacturers. These manufacturers are constantly working on additions and improvements to their lines and as new and improved product information is available it is presented in World Oil with an identifying "flag" telling you that it supplements the manufacturer's data as shown in your Composite Catalog. In those cases where you want additional information or prices you are invited to write directly to the manufacturer whose mailing address is shown at the end of each description.

THE UNIVERSAL EQUIPMENT GUIDE FOR OIL COUNTRY BUYERS

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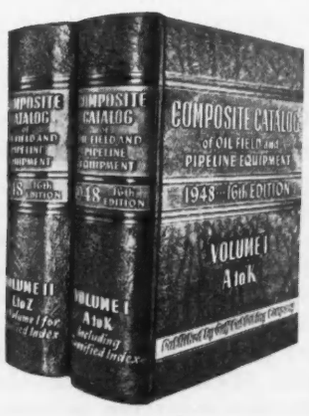

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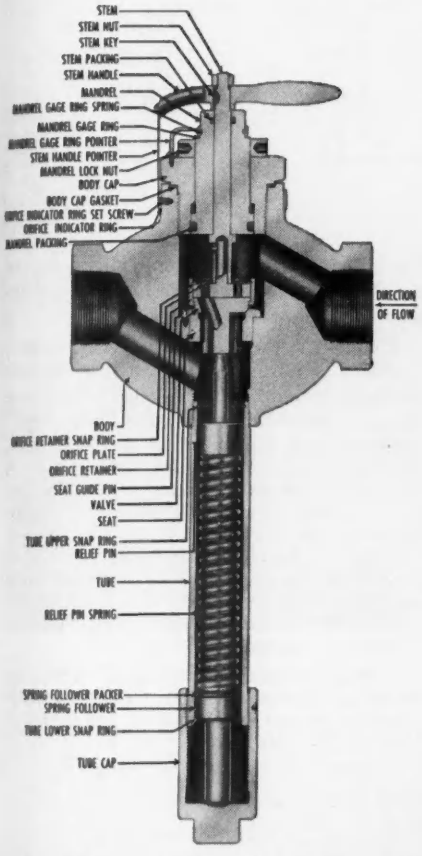
NEW AND IMPROVED Equipment SUPPLEMENTING COMPOSITE CATALOG

New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

154—Flow Control

This item supplements S. R. Bowen Company data as shown on pages 653-684 of Composite Catalog.



Installed on the flow line at the well head, a new automatic flow control brings to operators many desirable features. Field tests have shown that the device will automatically control production, automatically prevent excessive loading, permit positive regulation at the lowest possible gas-oil ratio, reduce paraffin problems to a minimum, and automatically control gas surges.

It consists essentially of a body, a spring-loaded valve, and an adjustable orifice plate. The body provides the connections to the flow lines; the spring loading on the valve is controlled by adjusting the mandrel; the desired orifice in the orifice plate is selected by adjusting the stem handle. Upon installation, it is necessary to adjust the spring loading and the valve opening and to select the proper orifice to meet the particular conditions of the well. After a very short test period, the initial settings can be adjusted to the exact requirements.

For additional information, write S. R. Bowen Company, 11008 South Norwalk Boulevard, Santa Fe Springs, Calif., *referring to* WORLD OIL *item* 154.

155—Junk Remover

This item supplements Houston Engineers, Inc., data as shown on pages 1764-1766 of Composite Catalog.

Designed to catch and remove junk that might be dropped into the hole and result in an expensive fishing job, the "Junkup" is a simple device which can save operators lost time in trying to pull a tight tool which has been wedged by a tong key, hammer head, stud nut or some other piece of iron dropped on top of the tool.

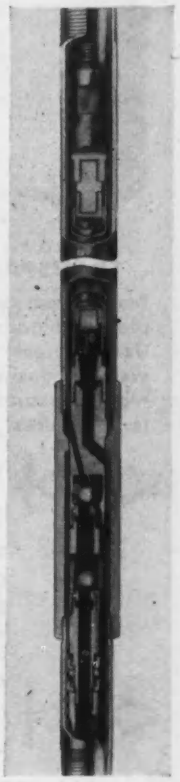
The device is a molded rubber cup which may be fitted over the top of a packer. It is millable or drillable as added protection against loss of a hole. The rubber is oil, acid and wear resistant. Perforations in the cup give area for drain back, and also prevent the Junkup from floating in the hole. To install, it is thrust over the tubing threads and the collar finishes seating the cup to the upset.

For additional information, write

Houston Engineers, Inc., 1412 Ennis Street, P. O. Box 567, Houston, *referring to* WORLD OIL *item* 155.

156—Hydraulic Pump

This item supplements Emsco Derrick & Equipment Company data as shown on pages 1201-1228 of Composite Catalog.



A three-tube fluid seal hydraulic pump has the addition of a bypass arrangement at the bottom. On the upstroke the fluid is drawn up through the lower or standing valve and through a passageway into the standing tube. The upper or discharge valve remains closed during the upstroke due to the fluid head in the tubing. On the downstroke the fluid is forced by the plunger from the standing tube and discharged through the bypass at bottom of the pump and travels upward through the tubing outside the pumping tubes instead of inside the pumping tubes as in conventional deep well pumps. Discharging the fluid at the bottom of the pump leaves no dead space for sand or other foreign matter to settle back around the pumping tubes. This increases the productive life of the pump.

Constant upward movement of the fluid around the outside of the pumping tubes rather than through the inside of the tubes reduces wear, and provides longer effective pump life in severe sand conditions. Sand in the fluid is kept moving upward which prevents "sanding up" the pumps.

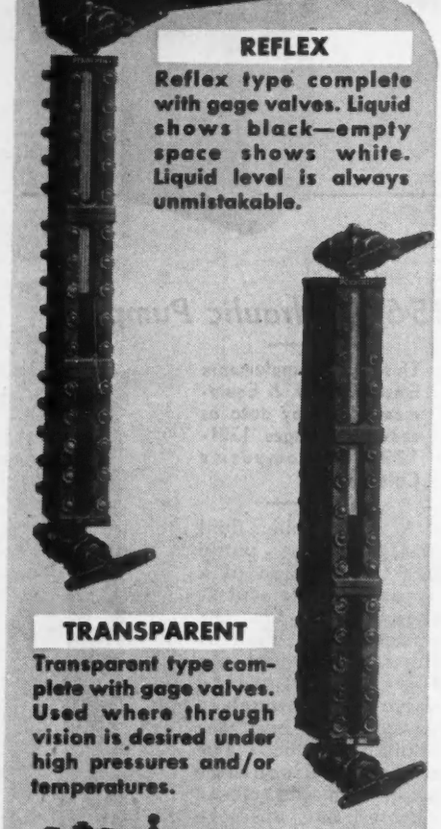
The V-K hydraulic pump may be installed in a conventional 18-inch seating nipple, or seated in the top of a common working barrel. By using an adapter, a conventional pump may be installed following a V-K hydraulic pump without pulling tubing.

For additional information, write Emsco Derrick & Equipment Company, Box 2098, Terminal Annex, Los Angeles 54, *referring to* WORLD OIL *item* 156.

PENBERTHY
Liquid Level GAGES

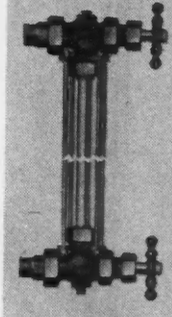
REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.



TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

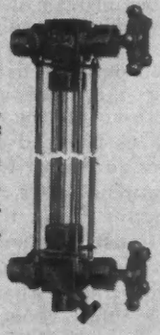


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.



There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

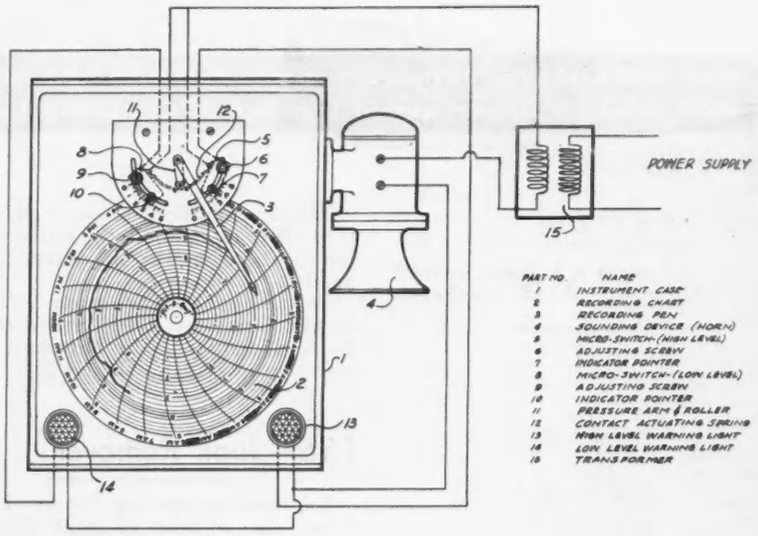
PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant — Windsor, Ontario

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

157—Mud Pit Level Alarm



This item supplements Warren Automatic Tool Company data as shown on pages 4218-4221 of Composite Catalog.

An automatic alarm device has been added to the Pit-O-Graph, an accurate method of recording mud pit level on a 24-hour basis. The device causes an electrical horn to sound when the level in the mud pit drops below or rises above predetermined points. When more mud is being pumped down the well than the volume of mud being returned, causing the pit level to drop suddenly, it can be assumed that the formations are taking fluid. On the other hand, if the pit level rises, occasioned by greater volumes of mud being returned than that pumped in the well, it is likely that formation pressures are forcing the fluid from the hole and a blowout is eminent. Warnings of these two extreme cases make it possible to overcome the difficulty in ample time to prevent a loss of circulation or a blow out.

Heart of the device is two micro switches actuated by the angular motion of the recording pen. When the pit level rises to the critical point, the "high-level" micro switch closes an electrical circuit, causing the horn to be energized. A similar action takes place when the pen drops near the center of the record due to a drop in fluid level in the pit. Power is supplied by a transformer connected to the rig power supply. Low and high level warning lights are mounted on the recording unit for visual indication in addition to sound of the horn.

For additional information write the Warren Automatic Tool Company, 1920 Hussion Street, Houston 3, *referring to* WORLD OIL *item* 157.

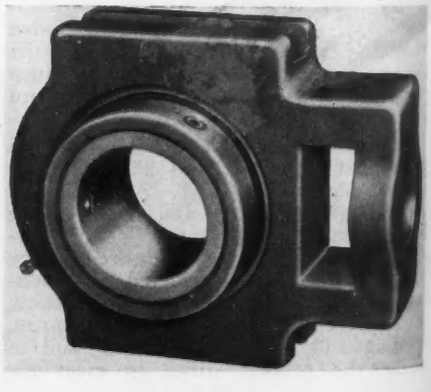
158—Take-Up Unit

This item supplements Dodge Manufacturing Corporation data as shown on pages 1141-1152 of Composite Catalog.

A new ball bearing take-up unit consists of a deep groove precision bearing with large balls and retainer to minimize wear. Enclosed in a rugged outer housing, it has wide milled slots or ways on each end for supporting guides. The housing has a hole for receiving the unthreaded end of an adjusting screw.

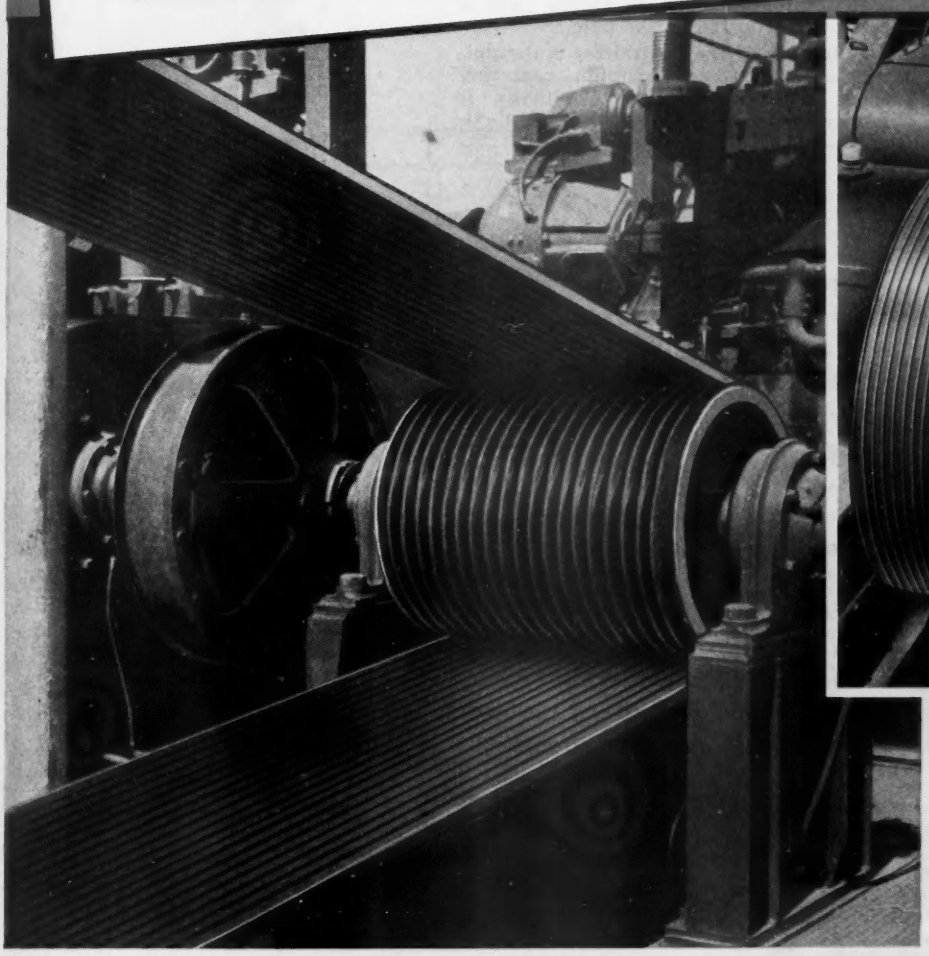
The device, known as the Wide Slot SC Ball Bearing Take-Up Unit, is suitable for conveyor and power transmission service where provision must be made for changes in shaft position.

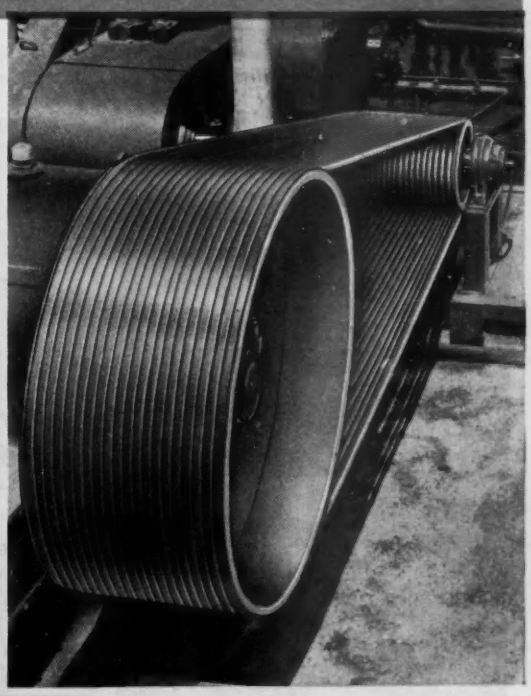
For additional information, write Dodge Manufacturing Corporation, 1938 William Street, Mishawaka, Ind., *referring to* WORLD OIL *item* 158.



RUGGED - DEPENDABLE

DAYTON V-BELTS ARE BUILT WITH RAYON GUTS*





There's no tougher service for V-Belts anywhere than in the oil fields. And Dayton V-Belts will give you more for your money regardless of how you use them.

Because Dayton V-Belts are built to take it. Sand, dust, heat and rain have no effect. They stand up under the most adverse conditions. Raytex Fortified Cords are the reason . . . specially processed Rayon . . . built right in for extra strength.

It's this extra strength that means *minimum stretch, greater flex strength* and *longer, trouble-free V-Belt life* on your oil field drives . . . qualities that result in fewer "take-ups", less maintenance, smoother starting and stopping, far less bearing wear. It's no wonder most oil field men choose Daytons . . . standardize on Daytons.

For on-the-spot stocks of Dayton V-Belts and for field assistance by oil field experts, call or write the *Continental Supply Company, Dallas, Texas.*

V-Belts by **Dayton Rubber**

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

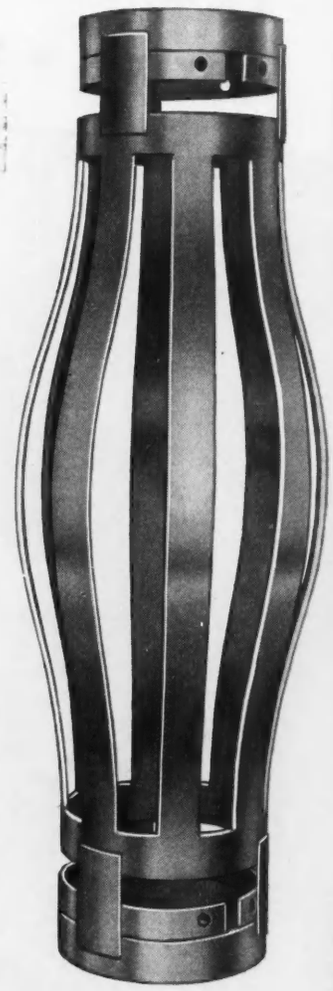
SERVICE BY **Continental**

159—Casing Centralizer

This item supplements Baker Oil Tools, Inc., data as shown on pages 413-516 of Composite Catalog.

Maximum centering force that can be applied to the casing during hole conditioning and centering operations is afforded with the Model "G" casing centralizer. In addition, the device permits free rotation of the casing in order that rotational wall scratchers may be used effectively, as well as reversible wall scratchers when the casing itself is to be reciprocated in the hole.

A feature of the centralizer is its ability to exert the maximum centering force when the casing eventually is landed in the open hole. It has the flexibility of a "long spring" centralizer, as well as the stiffness of a "short spring" type. It has the centering force of a "deep bowed spring" type centralizer without its susceptibility to a permanent set.



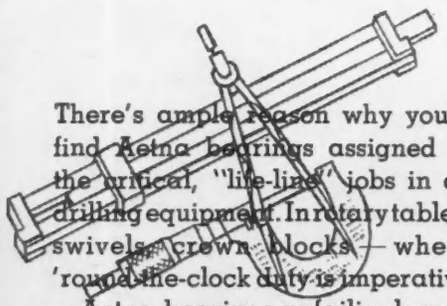
Three sizes of springs are provided for each popular size of casing up to and including the 8⅝-inch size. Proper spring variation for the particular size casing being run in the hole is coordinated with the size casing through which the centralizer is to run. Both factors are in turn related to the size of the open hole in which the centralizer will perform.

By placing the stop rings on the outside of the centralizer, rather than in their conventional position inside the device, the feature of unrestricted rotation of the casing has been separated from the centralizing feature. Springs are free to deflect along the smooth, flat surface of the casing, and are not bent over sharp corners or projections, stop rings, centralizer collars or casing couplings.

For additional information, write Baker Oil Tools, Inc., Box 2274, Terminal Annex, Los Angeles 54, *referring to* WORLD OIL *item* 159.

Aetna
BEARINGS
ARE
ENGINEERED TO
CUT
DRILLING
COSTS

Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings



There's ample reason why you'll find Aetna bearings assigned to the critical, "life-line" jobs in oil drilling equipment. In rotary tables, swivels, crown blocks — where 'round-the-clock duty is imperative —Aetna bearings unfailingly pay off . . . avoid costly down-time . . . pare down maintenance expense . . . stretch equipment life.

For your next *vital* applications, SAVE WITH AETNAS . . . the bearings custom-engineered to the *extra* capacity and endurance requirements of oil country machinery.

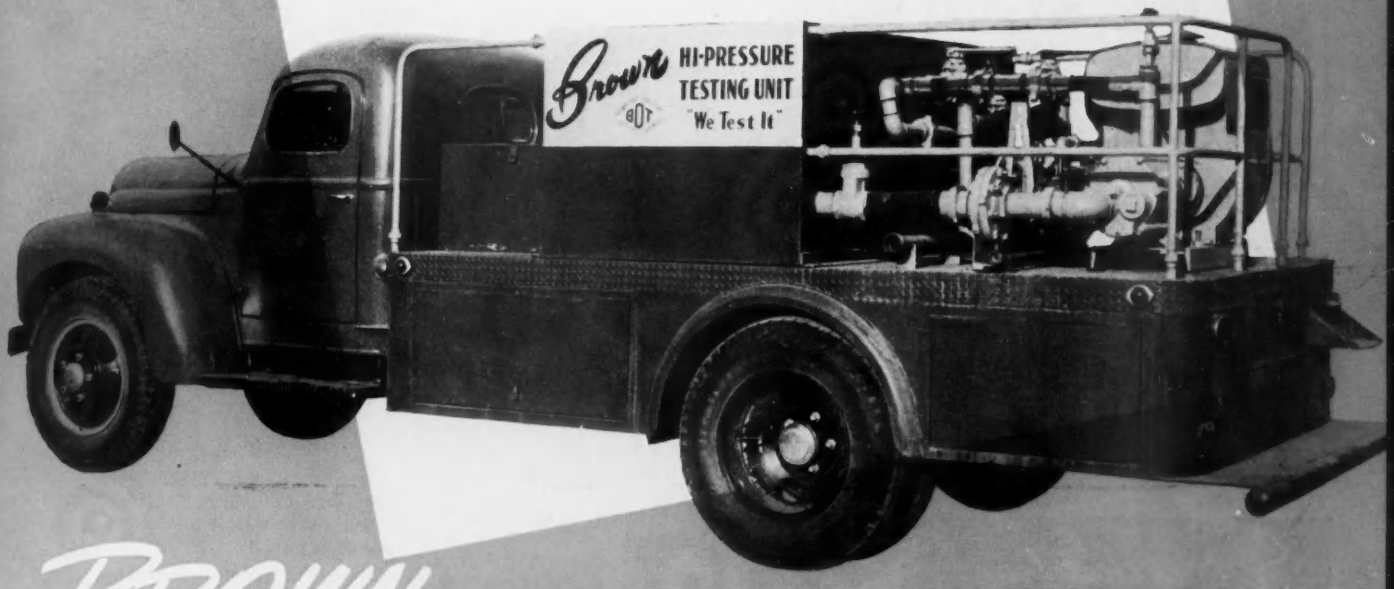
AETNA BALL AND ROLLER BEARING CO.
4600 Schubert Avenue
Chicago 39, Illinois

Write for Engineering Catalog and name of nearest field engineer.

EQUIPPED FOR SIZES UP TO 38 INCHES O. D.

Aetna
BALL AND ROLLER BEARINGS

DON'T BE HALF ~~1~~ 2 SURE !



BROWN HYDROSTATIC TESTING UNIT
IS THE ONLY SURE WAY TO KNOW YOUR PIPE IS PRESSURE-SAFE

Don't guess and speculate about the condition of your pipe and pressure vessels. Be sure they will withstand the pressures at which they are to be used. Brown Hydrostatic Testing Unit gives you proof of their fitness for service, on the spot, quickly and economically.

This truck mounted unit, capable of developing 20,000 pounds pressure, can be brought to your location, and test your equipment at pressures as great or greater than service conditions.

The testing unit is equipped with a special control device, enabling the operator to pre-set testing pressure. It cannot develop more than this pre-set pressure, thereby eliminating the danger of applying undue stress to your equipment.

Water or other hydraulic testing medium is carried in the trucks own tanks. After filling and testing the equipment, the fluid is withdrawn into these same tanks, instead of being dumped.

Pipe can be tested on a truck, in the yard, on derrick racks or standing in the derrick. Quick change testing plugs eliminate danger of galling threads.

Don't be half sure . . . don't take chances. Have your pipe and pressure vessels hydrostatically tested with the BROWN HIGH PRESSURE TESTING UNIT and be sure they are safe for service.

BROWN OIL TOOLS, INC.

Sales Office: State National Bldg. Plant: 2200 Campbell St.

HOUSTON, TEXAS

EXPORT SALES: Acme Well Supply Co., 19 Rector St., New York 6, N. Y.

DIAMOND CORING

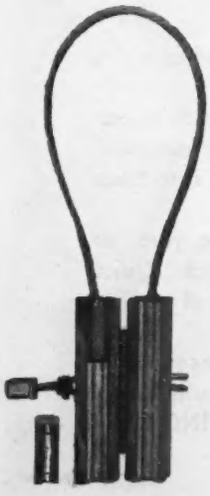
brings...
✓SPEEDIER PENETRATION
and...
✓GREATER RECOVERIES

✓DIAMOND CORE BITS ...for sale
✓SPECIAL CORE BARRELS for rent or sale
✓SERVICE ENGINEERS

DIAMOND OIL WELL DRILLING COMPANY
MIDLAND, TEXAS
815 Midland Tower Phone 2710
OKLAHOMA CITY, OKLA.
Phone 62-1538

Spare that line!

Approximately 6000 feet of line can be spooled TIGHT on the drum with assured safety, before you need to change the removable bronze liners of the S-I-W Line Tightener.



SPOOL TIGHT WITH AN S-I-W LINE TIGHTENER

An adjustable hasp permits quick opening and closing of the S-I-W Line Tightener. A cable loop permits easy swinging from the derrick. Closed, the S-I-W Line Tightener grips running line firmly for even drum spooling. Steel liners can be supplied at no extra cost.

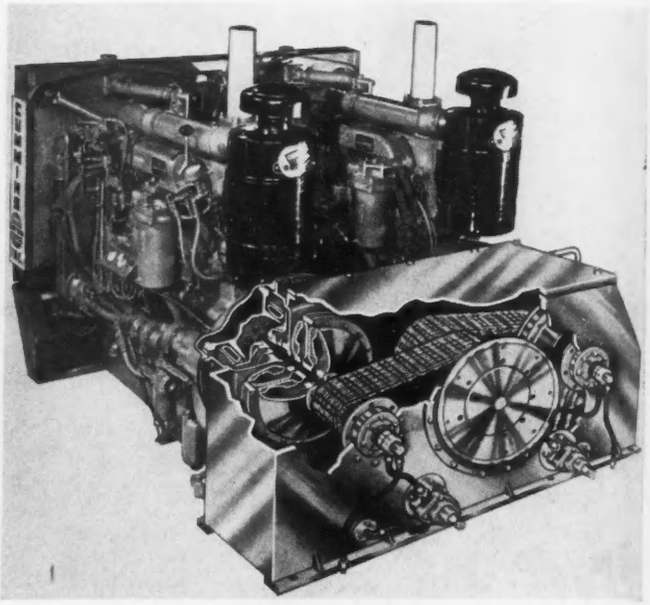
Sunshine Iron Works
601 W. MURPHY - PHONE 4374 - ODESSA, TEXAS

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

160—Hydraulic Power Unit

This item supplements Cummins Sales & Service, Inc., data as shown on page 1088 of Composite Catalog.



A two-engine "power team," incorporating two Cummins diesel engines mounted in one with hydraulic couplings, has been developed to provide more flexible power with less fuel over longer periods of continuous operation. The system eliminates shock loads, torsional vibration and excessive strain.

Hydraulic couplings tend to overcome inadequate torque at starting speeds, and serve to break the solid connection between engines and driven equipment, since power is transmitted entirely by the mass and velocity of moving oil.

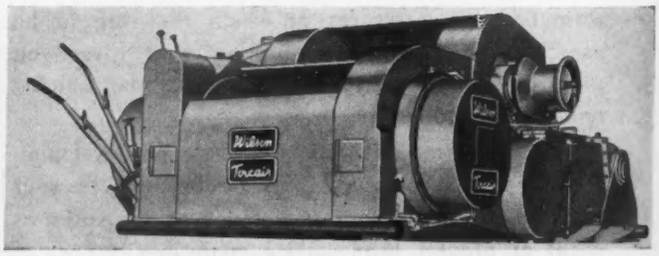
A choice of five engines is available for use in the assembly. When the Dual NH Model illustrated is used, the unit will develop 360 horsepower maximum, 312 horsepower intermittent, and 280 horsepower continuous at 1800 revolutions per minute.

A mechanical drive system for use with torque converter is also available. Standard equipment is identical in most cases, except that all hydraulic elements are eliminated.

For additional information, write Cummins Sales & Service, Inc., Mid-Continent Building, Fort Worth, *referring to* WORLD OIL *item* 160.

161—Double-Drum Winch

This item supplements Wilson Manufacturing Company, Inc., data as shown on pages 4341-4376 of Composite Catalog.



Truck mounted for quick portability and immediate operation, the Super Torcair double drum winch is used for servicing wells up to 6000 feet with 2½ inch tubing.

The winch is air controlled throughout. An air throttle on the engine combined with the air control for air-tube disc clutches makes it possible to keep the controls to a minimum. One valve controls both high and low drum clutches and engine throttle to operate the main drum while another valve controls the drum clutch and the engine throttle to operate the sand drum.

The lower drum is equipped with rolled alloy steel brake rings and is set up for water spray cooling. Drum barrels are reinforced and drum ends are cast steel.

A friction clutch operated oil bath rotary drive jackshaft is provided. The shaft may be set up with either a mechanical friction clutch or an air-tube disc clutch. The shafts are heat treated steel accurately sized. SKF self-aligning roller bearings are used. Chain drives are run in a bath of oil for longer life.

For additional information, write Wilson Manufacturing Company, Inc., P. O. Box 329, Wichita Falls, Texas, *referring to* WORLD OIL *item* 161.

RATE OF CORROSION REDUCED 98%

with KONTOL

A CORROSION PREVENTIVE DEVELOPED AND MANUFACTURED BY THE TRETOLITE COMPANY

REDUCES FREQUENCY OF WELL-PULLING — Effective corrosion prevention increases the useful life of rods, tubing and pumps.

STOPS PITTING — In the majority of cases, the tendency toward pitting is eliminated.

EASY TO USE — Just pump or dump periodically down well annulus.

ECONOMICAL — One quart per million feet of gas, or ratio of one to 10,000 in oil wells.*

*Ratios based on average of tests to date. Particularly corrosive conditions may call for more Kontol — mild conditions for less.

Extensive testing has shown that in the average corrosive gas-condensate well, the injection of one quart of KONTOL per million cubic feet of gas produced will reduce the corrosion rate of well equipment by 90% or more – *reductions by as much as 98% are not unusual.* KONTOL is equally effective in reducing corrosion in gas, gas-condensate, sweet crude and sour crude wells.

INVESTIGATE KONTOL NOW

It is already saving time, labor and steel for many producers. For detailed information on KONTOL, or particulars regarding the KONTOL rate of corrosion test service, just call or write

KONTOL

CORROSION PREVENTIVES

TRETOLITE COMPANY

Manufacturing Chemists

St. Louis 19, Missouri
Los Angeles 22, California

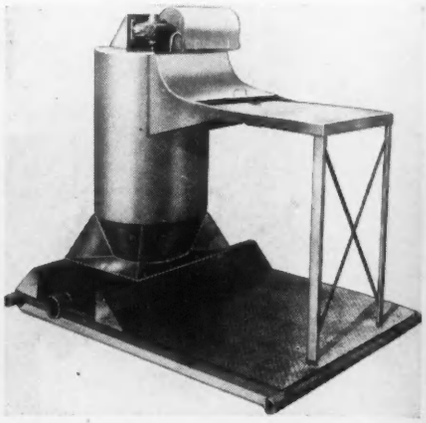
KG-49-3

OTHER NEW AND IMPROVED *Equipment*

162—Mud Mixer

A metering mud mixer departs from conventional design in that it meters the flow of dry chemical mud prior to its combination with wet mixture. Mixing takes place in a specially-engineered selective jet nipple chamber, available in any inside diameter from one-half-inch to 1½-inch. As the sacked mud pours into this chamber, it is measured out through an adjustable metering hole which affords accurate control of the chemical mud used. Efficient mixing obtained by pump pressure in the jet nipple chamber keeps the dry and wet mud positively united in the mud pit. The mixer produces a bottom-hole lubricant that is cohesive and uniform in viscosity.

The mixer weighs 840 pounds, and is built with skids and lifting eyes for mobility. A horizontal loading platform



joined to the top of the hopper accommodates mud sacks. Each sack, when pushed forward over a star-shaped rotating cutter mounted on this platform, empties into the hopper chute.

Next to the hopper bottom is a rotating disc with slots cut 90 degrees apart. It rotates above a V-type sliding gate which can be set to dispense any amount of dry chemical mud desired. This sliding gate is positioned for adjustment from outside the mixer. It controls the amount of sacked drilling mud used to obtain proper drill mud viscosity. The new mixer uses alternating or direct current. Each unit is weatherproof and requires no protective housing.

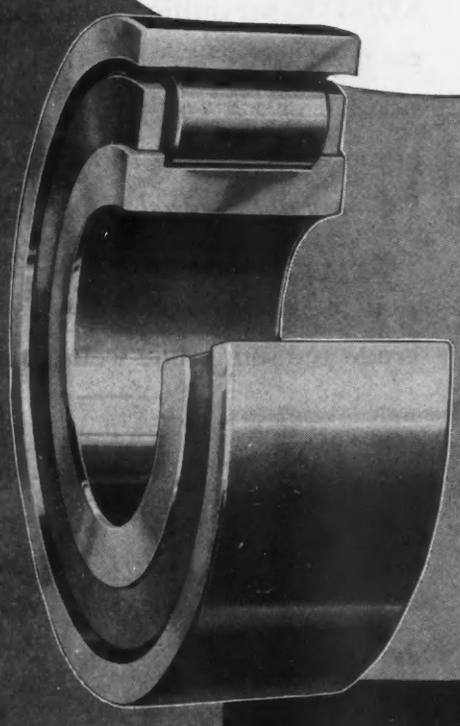
For additional information write Empire Machinery Company, Ltd., Odessa, Texas, *referring to* WORLD OIL *item* 162.

Install Them and Forget Them!

AMERICAN

RADIAL

Roller Bearings



AMERICAN RADIAL ROLLER BEARINGS are engineered to exacting standards that result in better performance and minimum maintenance.

Furnished in 5 styles, 6 S.A.E. series and 85 sizes. Special designs also available. Write.

AMERICAN ROLLER BEARINGS HEAVY DUTY

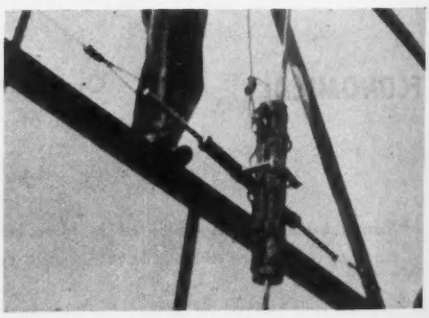
AMERICAN ROLLER BEARING CO.

420 Melwood Street Pittsburgh, Pa.

Pacific Coast Office:

1718 S. Flower St., Los Angeles, Calif.

163—Line Guide Stabilizer



The Coleman Hydraulic Line Guide Stabilizer was designed to keep the drill line spooling smoothly on the drum by eliminating whipping, which is the primary cause of improper spooling.

This is accomplished by means of a piston with bypass openings operating inside a cage filled with lubricating oil. A slight pressure of the drill line upon the line guide, which is attached to the cage, will move the cage smoothly and evenly by displacing the oil through the bypass openings in the piston. Any sudden surge of the drill line will stop the cage instantly, thus preventing the line from ever starting to whip.

For additional information, write M. A. Lamkin Company, P. O. Box 8007, Houston 4, *referring to* WORLD OIL *item* 163.

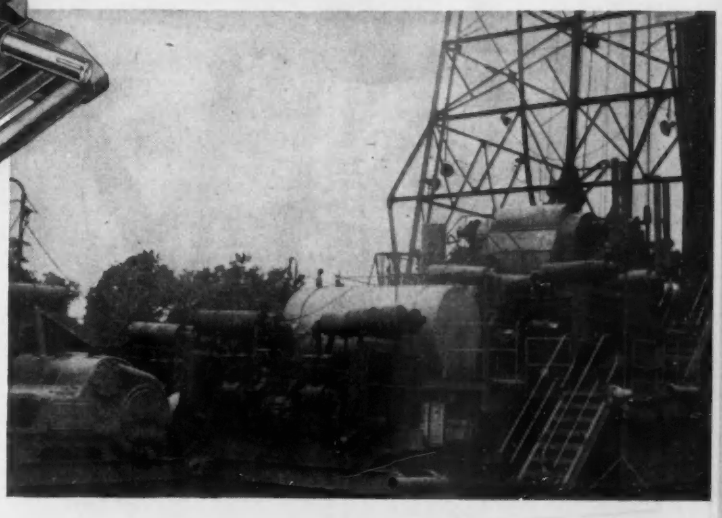
What do you want...

"Just drilling engines" or

DEPENDABLE POWER

for your rig?

There is more to buying an engine than just the merits of the engine itself because even the best engine is no better than the parts and service organization behind it.



HERE'S WHAT YOU GET WHEN YOU BUY A DRILLING ENGINE FROM STEWART & STEVENSON SERVICES

1. GM DIESEL POWER

GM Diesels feature high horsepower, compactness, light weight and extreme reliability as well as true Diesel fuel economy. They are available in a complete range of sizes up to 800 horsepower per unit and their extra flexibility makes them especially suitable for drilling use.

2. ENGINEERED INSTALLATION

In addition to simply selling engines, our engineers help you select the engine best suited to your purpose. Our factory designs and fabricates the substructures, drives and other necessary accessories and our factory-trained engineers make sure the engines are properly installed.

3. GUARANTEED PERFORMANCE

A Stewart & Stevenson Service Engineer stays on the job until everyone is positive that the installation is giving the performance you want. If anything is wrong, we make it right, regardless. You can't lose.

4. SERVICE WHEN AND WHERE YOU NEED IT

Strategically located service engineers are on call day or night. They can reach any point in Texas in a minimum of time. In addition, they are backed up with the largest stock of GM Diesel parts *anywhere*. This speedy service protects you from costly shutdowns.

You're buying more than an engine when you buy from Stewart & Stevenson — you're buying an insurance policy for dependable service.

For full information, see your local Stewart & Stevenson representative today.

STEWART & STEVENSON SERVICES, Inc.

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4516 Harrisburg Blvd.	4801 Lemmon Ave.	643 N. Port Ave.	19 East Highway	P. O. Box 1415	P. O. Box 546	1624 4th Ave.
Phone W. 6-9691	Phone L. 6-6649	Phone 8252	Phone 1760	Phone 2-3319	Phone 2007	Phone 2-7538

DEALERS:
Sabine Propeller & Marine Service, Port Arthur, Texas
Balch Truck & Implement Company, San Angelo, Texas
Phillips-Torgerson Company, San Antonio, Texas
Standard Engine Company, Longview, Texas

SALES REPRESENTATIVES

BEAUMONT	LONGVIEW	LIVINGSTON	LAREDO	SAN ANTONIO
Phone 2-9619	Phone 3292-R	Phone 429-G	Phone 1513	Phone S. 4-2148

GM GENERAL MOTORS DIESEL POWER

CONTINENTAL-MOTORS Powerful in the Nation AMERICA'S STANDARD

PARTS • SERVICE
ANYTIME • ANYWHERE

DISTRIBUTORS OF: General Motors Diesel Engines 30 to 800 horsepower • Chicago Pneumatic Gas and Diesel Engines 300 to 1650 horsepower • Continental Red Seal Gas and Diesel Engines 10 to 200 horsepower • Adel Hydraulic Controls Gardner-Denver Pumps

FABRICATORS OF: Electric Power Units • Electrical Control Equipment • Truck Bodies Portable Pumping Units, Etc.

*GM Diesels not available at this branch

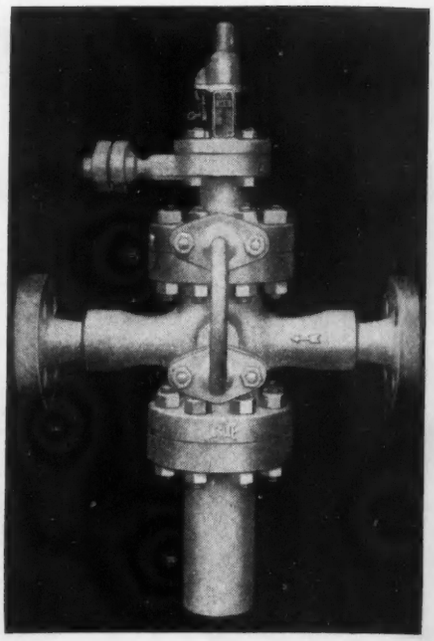
THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

164—Pressure Reducing Valve

A high-pressure reducing valve, known as Class HS, employing internal pilot piston operated construction is designed for steam, air or gas service. It handles inlet steam pressures from 300 to 1500 pounds per square inch and air or gas inlet pressures from 300 to 3000 pounds per square inch. Reduced pressure range is from 100 psi to 600 psi. Maximum inlet temperature is 1000° F.

The valve is constructed of cast chrome moly steel body with integral stellited seating surface. It is available in sizes 1, 1¼, 1½ and 2 inches with Series 90 or 150 flanges or welded ends. The valve has a monel diaphragm, with the main valve of hardened stainless steel with stellited seating surface, solid stellite controlling valve, and hardened stainless steel cylinder liner and piston.

No change of spring or diaphragm is needed from minimum to maximum reduced pressure setting. The valve is single seated, closing with the inlet pressure for positive dead-end shut off. It has instant corrective reaction to any flow change.

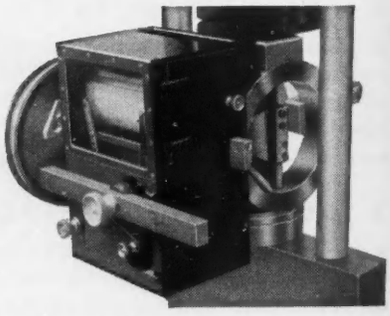


There are no stuffing boxes. To eliminate the effect of turbulence and pressure drop at outlet body throat, an external control pipe connection for reduced pressure is furnished.

For additional information write Leslie Company, 167 Delafield Avenue, Lyndhurst, N. J., *referring to* World Oil *item* 164.

165—Pumping Well Dynamometer

The J-F Dynamometer is installed on the polish rod of a pumping well to make a continuous record of all the forces acting on the polish rod at any particular instant of time. It is accurate to between .2 and .3 of 1 percent. The unit is portable and rugged in construction. It is furnished in two ring sizes to cover all load ranges, with three scale settings per ring.



It not only gives peak loads, minimum loads and polish rod horsepower, but also tells the peak torque on the gears. From the dynamometer card record may be obtained much information about the performance of both the well and the pumping equipment.

For additional information, write Johnson-Fagg Engineering Company, 4020 South Peoria, Tulsa, *referring to* World Oil *item* 165.

ALTEN PUMPING UNITS

Better than ever

Long-time users tell us the NEW Alten Units are even better than the highly-regarded early models. That's no surprise to us. We've added many design and construction improvements—but only after field testing proved their worth. Try them for yourself.

Also Casing Heads, Stuffing Boxes, Stop Cocks and other production items.

A-50 FEATURES

★Rigid, all-welded steel Samson Post, Frame and Beam. Structural rating: 5,100 lbs.

★Quality Gear Reducer. Hardened alloy gears and pinions. Roller-bearing equipped. Double reduction ratio: 28.4:1. Torque rating 24,750 in. lbs.

★Adjustable stroke length: 18" to 30".

★Wrist Pin and Equalizer has double-row, spherical, self-aligning roller bearings.

ALTENS
FOUNDRY & MACHINE WORKS, INC.
Lancaster, Ohio
Established 1889
Ask for Name of Nearest Dealer

NEW! The JOY #150 MOTORIZED DRILL RIG

Latest in Design First in Performance

JOY'S new #150 Motorized Drill Rig is designed for heavy-duty seismograph, electrical logging, structure testing and shallow water well drilling down to 1500 feet. It incorporates the most modern improvements in drill rig design—has proved itself outstanding in the field within its capacity range. Note these exclusive features:

- ★ **All chains are oil-bath lubricated and run in oil-tight cases.**
- ★ **Equipped with conventional oil-bath rotary table with 6⅜" opening. For running larger casing, the rotary table is retractable 14 inches.**
- ★ **Mast elevating and lowering cylinders are arranged to eliminate over-travel on either the up or down stroke.**
- ★ **Main drum clutch and sand-reel clutch use same friction plates.**

WRITE FOR BULLETIN

Consult a Joy Engineer

W&D 02195

The efficient and highly portable #150 Motorized Drill Rig on the job.

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

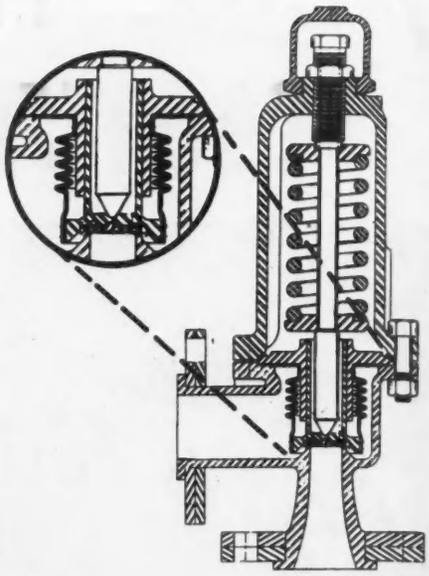
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

166—Safety Valve Bellows

A new type of safety valve construction completely isolates the lading fluid from the valve spring chamber and guide surfaces. The FarriSeal Bellows, or flexible joint, seals the spring, guides, adjusting screws, etc., from the vapor or fluid in the body of the valve. The guide cannot become fouled and corrosion is minimized.

This type of safety valve is of particular advantage in connection with back pressure surge applications. In such applications, the back pressure surges usually cause a valve to pop early or late thereby causing the valve to relieve at an incorrect pressure. With the FarriSeal Bellows complete graphs are set up allowing the user to predetermine the point at which the valve is to be set in order to eliminate the error of back pressure surge.

A great cause of failure in safety relief valves is due to the attack of the acids on the valve spring itself, which is therefore a most vulnerable point. The



flexible joint prevents gases or liquids from entering the spring chamber, and at the same time it does not retard the operations of the valve.

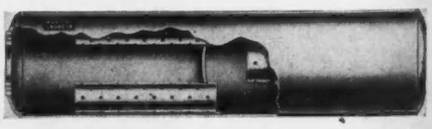
The joint is an enveloping bellows built into the valve itself. It is made in type 316 stainless steel as a standard, and is also available in rubber and Neoprene for the chemical and corrosive-resistant types valves particularly.

The bellows are so constructed as to allow the safety valve its full stroke plus over travel, and at the same time never to reach the stress limits of the bellows themselves.

For additional information write Farris Engineering Corporation, 480 Commercial Avenue, Palisades Park, N. J., *referring to* WORLD OIL *item* 166.

167—Air Intake Snubber

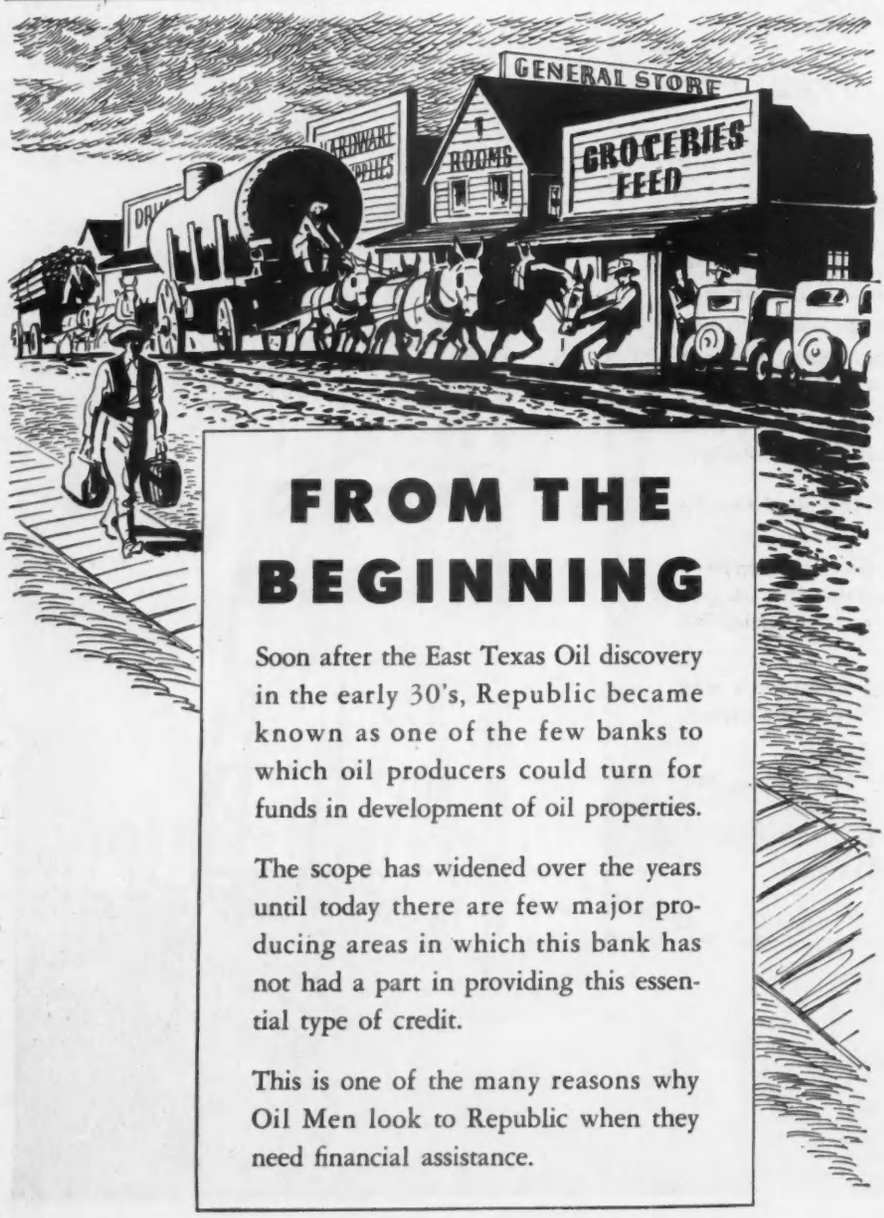
A new line of air intake snubbers can be used on all two- and four-stroke cycle stationary and marine engines, whether diesel, gas, or dual fuel. They are also designed for intake of all centrifugal and positive displacement compressors and blowers. Designated as



Series SDA, these units are available in pipe sizes from one to 30 inches, inclusive.

Incoming pulses of air are snubbed so that the oscillating flow of air, which causes "pumping" noise, is smoothed to a unidirectional flow. There is no appreciable restriction of the intake pipe. No tuning of the air intake system is necessary. On compressor intakes, however, the snubber performs best when closest to the compressor. Air intake snubbers are commonly used in series with a removable filter element to insure clean intake air.

For additional information, write Burgess-Manning Company, Libertyville, Ill., *referring to* WORLD OIL *item* 167.



FROM THE BEGINNING

Soon after the East Texas Oil discovery in the early 30's, Republic became known as one of the few banks to which oil producers could turn for funds in development of oil properties.

The scope has widened over the years until today there are few major producing areas in which this bank has not had a part in providing this essential type of credit.

This is one of the many reasons why Oil Men look to Republic when they need financial assistance.

CAPITAL AND SURPLUS — $25,000,000 . . . LARGEST IN THE SOUTH

REPUBLIC NATIONAL BANK of DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Precision is Tradition at

Pittsburgh Steel

Your oil country tubing and casing will tong up tight with a minimum of leakers if it's Pittsburgh Seamless. For the precision threading of quality seamless tubular goods has long been a tradition at Pittsburgh Steel—a tradition backed by exacting control of every other step in the manufacturing process as well. To enjoy the economy of tight, strong joints—specify Pittsburgh Seamless. For complete information write to Dept. OG, Pittsburgh Steel Company, Grant Building, Pittsburgh 30, Pa.

Lewis F. Case—Inspecting precision threads on oil well tubing at Pittsburgh Steel Company.

Pittsburgh Steel Company

NOW 3 FINE
Jimmie Gray
COMPOUNDS

INSURE
LONGER LIFE FOR
TOOL JOINT THREADS

EXCLUSIVE 500 TON SPECIAL

You can always break the joint when you use Jimmie Gray Compounds! Each one is engineered to do certain specified jobs best!

KANT-GALL TOOL JOINT COMPOUND

Both new compounds have the same dependable quality, the same money-back guarantee as the widely used Jimmie Gray 500 TON Special!

LONG-LIFE DRILL COLLAR COMPOUND

SOLD BY SUPPLY STORES EVERYWHERE

PETROLEUM DISTRIBUTING COMPANY
Formerly STANDARD OIL SALES CO.
BOX 203 HOUSTON, TEXAS
CHARTER 4-5648

PETROLEUM ENGINEERS
CABLE & STINE
WICHITA FALLS, TEXAS

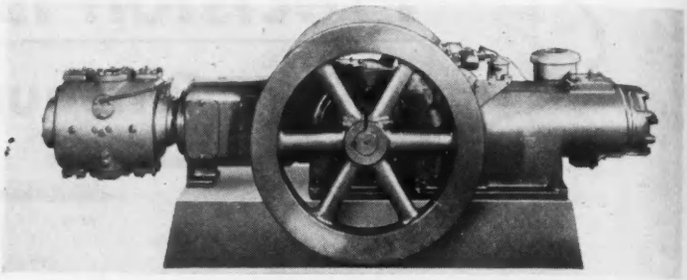
EXPERIENCED PRACTICAL
AND TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE

•

SPECIALIZING
in
MODERN
SECONDARY
RECOVERY

OTHER NEW EQUIPMENT

168—Air or Gas Compressor



An air or gas compressor powered by a multi-fuel engine consists essentially of a single-stage, positive - displacement cylinder driven through a cross head by a Lorain engine. Designed to operate at 250 to 450 revolutions per minute, the compressor delivers air or gas at pressures up to 150 pounds per square inch. The compressor cylinder is equipped with a bottom discharge for gas condensates.

The Model 0 engine produces from 17 to 34 brake horsepower and is designed to operate on diesel oil, clean crude, natural gas or butane. The engine can be converted in the field in approximately 90 minutes. The large-capacity oil reservoir and condenser-type cooling system are adequate for all load conditions regardless of climatic temperatures. The engine can be supplied with air starting valves or gasoline-driven friction starter.

For additional information write White-Roth Machine Corporation, Lorain, O., *referring to* WORLD OIL *item* 168.

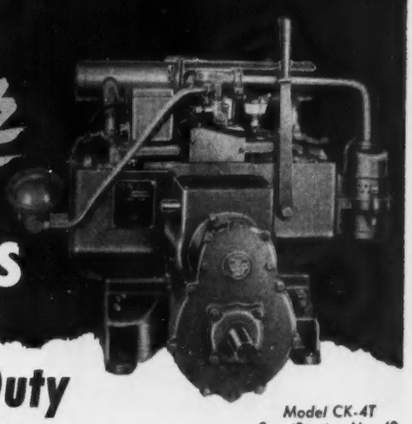
169—Take-Up Units

A series of take-up units, designated Type LTU, is especially adaptable for conveyor construction, shaft adjustment and belt tightening devices. In shaft sizes ranging from ¾ inch to 2 7/16 inches these units incorporate pre-lubricated, self-aligning wide inner ring ball bearings with self-locking collars and frictionless seals.

Construction provides the effective sealing operation of a long labyrinth plus that of an external slinger. An inner steel plate shield attached to the bearing's outer ring retains lubricant, while a rotary slinger attached to the bearing's inner ring throws off contaminants.

For additional information write The Fafnir Bearing Company, New Britain, Conn., *referring to* WORLD OIL *item* 169.

ONAN "CK"
Oilfielder
ENGINES



Built for Continuous Duty
on Tough Pumping Jobs!

Do you have a job for a 5½ HP roughneck? Here's a dependable 1000-inch-pound torque engine that will do a job for you day-in and day-out with minimum maintenance and attention. No cooling problem because it's air-cooled. Little or no sludging. Has features of an engine many times its size. Smoother-running because of its twin-cylinder, horizontally-opposed engine.

Full pressure lubrication by gear-type oil pump. Runs on either gas or gasoline. Check with your supply house or write. ONAN OILFIELDER ENGINE—5½ HP. ONAN ELECTRIC PLANTS—A.C.: 350 to 35,000 watts. D.C.: 1200 to 15,000 watts. Gas-gasoline and Diesel models.

D. W. ONAN & SONS INC.
5353 Royalston Avenue • Minneapolis 5, Minnesota

Model CK-4T
Specification No. 49
5½ HP (API)

• 1000-inch-pound torque • 5½ HP continuous duty (by API formula) • 960-ft. piston speed • 525 PTO shaft speed through 4.1 gear reduction • Over-center dry disc clutch • 4-quart oil sump • Air-cooled by axial-flow blower.

Onan PRODUCTS
ENGINES & ELECTRIC PLANTS

LABELED BY MANY AS THE
OIL INDUSTRY'S
MOST
PRACTICAL
WELLHEAD
ASSEMBLY
JE-1 Flow Control . . . four pieces in one — quick change wing valve.
B-2 Bonnet.
WA-4 Tubing Hanger—economical, flexible, fast — no costly permanent investment in rams.
T-16-OU Tubing Head — dual seal, reduced pressure area. Low flange stress.
C-19 Casing Head — self-sealing, flexible, safe, fast installation.

With the flexible O-C-T "C-19" Casing Head as the foundation . . . the only casing head that meets every well completion condition with a single compact model . . . this O-C-T Wellhead and Tree Assembly has set a new standard for simplicity, for safety, for service.

This O-C-T Wellhead and Tree Assembly is the result of progressive O-C-T engineering and field service experience based on sound study, exhaustive laboratory work and field testing, by experience-qualified O-C-T Engineers.

Yes, it's O-C-T quality from top to bottom . . . labeled by many as the oil industry's most practical wellhead assembly. Write for complete engineering details.

ASSOCIATION OF WELL HEAD EQUIPMENT MANUFACTURERS CERTIFIED

Oil Center Tool Co.

P. O. Box 3091, Houston, Texas

Export Representatives: Venezuela, Colombia, Peru, and Ecuador—Berry & Hall, Apartado No. 304, Maracaibo, Venezuela—Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Southall, Middlesex, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas.

QUICK *Pipe Reaming* THAT SAVES PIPE

RIDGID
Extra-Long-Taper Reamer won't thin, flare or split pipe

● Secret of the RIDGID's safe easy reaming is its extra long taper. With a few light ratchet turns, you whisk the burr from pipe or conduit without fear of thinning, flaring or splitting. You save time, work *and* pipe. Two sizes: No. 2, ⅛" to 2"; No. 3, ⅜" to 3." No. 2 reamer unit available without ratchet handle for use in RIDGID No. 00R threader handle. Ask your Supply House.

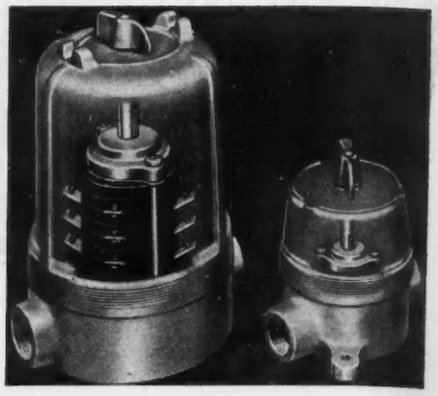
Reamer unit fits RIDGID No. 00R Ratchet Handle.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

OTHER NEW EQUIPMENT

170—Rotary Snap Switch

Rotary snap switches are available in explosion-proof, dust-tight, vapor-tight, weatherproof housings for hazardous locations. The assembly may be surface mounted with the switch handle on the dome, as shown, or can be furnished



with the switch shaft inverted and projecting through the base for panel mounting. Housings are standard Crouse-Hinds type EMS cases with an aluminum dome which screws on to a cast iron base. Standard conduit connections are provided in three-fourths inch for the shell case and one inch for the deep base.

Style 30H is rated at 30 amperes, 500 volts alternating current, and 250 volts direct current. The unit has a diameter of six inches and is mounted by four holes. The shallow type has a depth behind the panel of 7¼ inches and the deep type, 9½ inches. The shallow panel-mounted type extends 6¾ inches behind the panel, and the deep type, nine inches.

For additional information, write Electro Switch Corporation, Weymouth 88, Mass., *referring to* WORLD OIL *item* 170.

171—Wax-Free Oil

An all-purpose refrigeration oil has been introduced which is suitable for all refrigeration and air conditioning applications. The oil does not separate wax down to minus 70°F. in oil-refrigerant mixtures. Laboratory tests show the oil has a low pour point and will not decompose to form sludges or acids.

For additional information write Ansul Chemical Company, 3300 Hegley Street, Marinette, Wis., *referring to* WORLD OIL *item* 171.

172—Way Lubricant

A dual-purpose oil is for use in hydraulically operated machine tools that pressure-feed way lubricant from the hydraulic system.

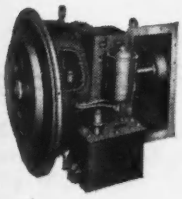
The lubricant has the stability and non-sludging characteristics of an hydraulic oil, as well as film strength and metal-wetting qualities.

Available in two viscosities, Lubeway 150 and Lubeway 300, the oil does not form gummy deposits in the pumps, lines, valves, or controls.

For additional information, write Sun Oil Company, 1608 Walnut Street, Philadelphia 3, *referring to* WORLD OIL *item* 172.

Softer Power for Harder Drilling

International Derrick and Equipment Company's Rambler Rig with H-40-D Hydrair Hoist shown on location.
Insert: Twin Disc Hydraulic Torque Converter (Lysholm-Smith type) mounted on H-40-D Hydrair Hoist.



On any location . . . in any formation . . . Ideco's Rambler Rigs have the power. It's soft power though, because it's transmitted through a Twin Disc Hydraulic Torque Converter which puts a hydraulic link in the hoist's power train.

This hydraulic transmission multiplies engine torque . . . eliminates engine lugging and racing . . . keeps the engine in the hi-power range.

Twin Disc's Three-stage Converters automatically adjust to the most favorable engine speed . . . instantly give maximum speed for raising empty blocks and maximum pull for coming out. Smooth transmission of power through fluid protects the engine and hoist against shock, cushions acceleration for hoisting and rotating . . . ideal characteristics for swabbing and fishing.

A pioneer in adapting torque converters to full oil field usage, Ideco has used Twin Disc Hydraulic Torque Converters for many years. For complete information on how Twin Disc Converters can smooth out your power transmission problems, write the Hydraulic Division for Bulletin 135-C. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

173—Drill Pipe and Tool Joints

A 12-page bulletin, No. 356, describing Spang-Chalfant's Double Seal shrink thread drill pipe and tool joints, features the new design, which has seals at both the internal and external ends of the pipe threads, as well as the shrink thread design. Methods of replacing tool joints are illustrated, and recommendations for the use and care of drill pipe and tool joints are included.

For a copy of this bulletin, write the Spang-Chalfant Division of The National Supply Company, P. O. Box 298, Pittsburgh, *referring to* WORLD OIL *item* 173.

174—Downwell Pumps

A brochure entitled "A Pump Is No Better Than Its Barrel" describes heat-treating and honing methods used in the manufacture of Oilmaster pumps. The treatise tells how pumps are mass produced by unique manufacturing techniques.

For a copy of this brochure, write Fluid Packed Pump Company, Los Nietos, Calif., *referring to* WORLD OIL *item* 174.

175—Sectional Drive Groups

An illustrated 16-page bulletin describes Ideal Type "AS" sectional drive groups for engines in the 300 horsepower range to be used with Types 75, 100, and 125 Consolidated drilling rigs. The brochure illustrates with pictures and diagrams five arrangements of 2, 3, and 4 section drives, and includes brief specifications of the sections and shafts.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, *referring to* WORLD OIL *item* 175.

176—Corrosion Control

A 28-page manual, "Corrosion Control for Underground Pipe," describes methods employed to protect underground pipe lines from corrosion and the role of Fiberglas pipe wrap in corrosion control. Test data on the properties and performances of the pipe wrap are included. The manual is illustrated with charts and photographs.

For a copy of this manual, write Owens-Corning Fiberglas Corporation, 1833 Nicholas Building, Toledo 1, *referring to* WORLD OIL *item* 176.

177—Stainless Castings

A new periodical, "Newscast," provides information about the uses and properties of stainless steel castings. Application stories depicting how alloy castings are used in industry, as well as technical data about the alloys, are presented.

For a copy of this publication, write The Cooper Alloy Foundry Company, Bloy Street and Ramsey Avenue, Hillside, N. J., *referring to* WORLD OIL *item* 177.

178—Multi-Pointer Gauges

Latest developments in Bailey Multi-Pointer gauges are described in Bulletin No. 163-B. Use of the diaphragm operated unit for measurement of pressure, draft or differential is explained in detail and some of the standard ranges available are listed. Four styles of casings are described in the illustrated bulletin.

For a copy of this bulletin, write Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10, *referring to* WORLD OIL *item* 178.

179—Well Head Equipment

An eight-page bulletin has been prepared by The National Supply Company to show "How to Install National Type B Pressure Pack Well Head Equipment." The bulletin pictures ten installation steps with descriptive captions and shows how the complete assembly may be tested any time without disturbing the well.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL *item* 179.

Use
Acme
Cable Tools
TRUSTWORTHY SINCE 1900
Sockets Designed for Hard Jarring . . .
Acme Sockets have a "yen" for toughest fishing jobs — hard jarring and all. As proved thru many years of helping Drillers recover . . . quicker and surer . . . so-called "hopelessly" stuck tools.
Their distinctive design embodies the half-century's accumulated experience of Acme's own fishermen . . . specialists famous for their successful record of meeting fishing problems.
From billets to final inspection, every factor for "ultimate" field service is rigidly enforced: PREMIUM-grade steel, to our invariable analysis specifications . . . forgings CORRECTLY heat-treated, under electric-automatic controls . . . craftsmanship to detailed EXACTNESS.
Acme Combination Sockets have that essential "built-in" design for extreme up-jarring, with least bursting stress: Correct spacing, depth, angle and ultra-hardness of slip-wickers . . . also unique design of slips and slip-seat taper.
Fig. 208 Acme Side-Slot Comb. Socket
Socket Slips
Use Acme's Full Circle Slip Socket (see right) for difficult, severe-jarring fishing jobs, in 6" holes and larger.
See Acme's latest Catalog and Manual in Composite Catalog (Vol. 1). Or mail penny postal TODAY for your copy . . chock-full of valuable information for every Cable Driller.
See other Acme Fishing Tools in panel (right) for more of EVERYTHING you need in a Trustworthy String.
There's More of EVERYTHING You Need In An Acme String
A
B
C
D
E
F
A—Babcock Rope Socket
B—Fishing Jar
C—Center Spear
D—Drill Mill
E—Ring Collar Socket
F—Full Circle Slip Socket (Catalog Fig. 229)
Acme Fishing Tool Co.
PARKERSBURG, W. VA.
Export Office: 19 Rector St., New York 6, N. Y.
ACME DRILLING & FISHING TOOLS
Since 1900

Associations

MID-CONTINENT AIME INSTALLS—Officers of the Mid-Continent Section, AIME, who were installed May 17 at Tulsa, are, standing, left to right, P. P. Manion, Stanolind Oil and Gas Company, executive committee; J. P. Hammond, Amerada Petroleum Corporation, executive committee; J. N. McGirl, Tide Water Associated Oil Company, second vice chairman; J. H. Beesley, Baroid Sales division, National Lead Company, secretary-treasurer. Sitting, left to right: R. H. Smith, Stanolind Oil and Gas Company, first vice chairman; H. M. Cooley, Bethlehem Steel Company, chairman.

AGA Convention Will Be Held October 17-20 at Chicago

The 1949 convention of the American Gas Association will be held October 17-20 in Chicago, Robert W. Hendee, president, announced.

Headquarters of the Technical section will be in the Morrison Hotel; the Accounting section in the Palmer House; and the Residential Gas section and the Industrial and Commercial Gas section in the Sherman Hotel.

George F. Mitchell is chairman of the General Convention Committee, which is developing programs for the three general sessions to be held on the mornings of October 18-20.

Hotel reservations may be secured through the AGA Convention Room Reservation Bureau, Room 808, 105 West Madison Street, Chicago 2.

Norman Is Reelected President Of Stripper Well Association

Victor L. Norman, California oil man, has been reelected president of the California Stripper Well Association. Reelected vice presidents were Edwin P. Crail, president of Victory Oil Company, and Laurence A. Donnelly, vice president of Exeter Oil Company, Ltd. Decatur Mitchell, president of the Coast Supply Company, was also elected a vice president. Thomas H. Work, of the Nordon Corporation, Ltd., and Richard Fenton were reelected secretary-treasurer and executive vice president, respectively.

A graduate of Oklahoma A. & M. College, Norman has been engaged in the oil industry since 1919, with the Marland Oil Company, Shell Oil Company, and with the Land and Legal division of Phillips Petroleum Company. Since 1938 he has been vice president and general manager of the Woolner Oil Corporation, Ltd.

New directors of the association who will serve with Norman are C. R. Edgecomb, Midland Petroleum Company; Mitchell, and C. F. Sudduth. All other directors were reelected.

Oil Companies Establish Engineering Fellowships

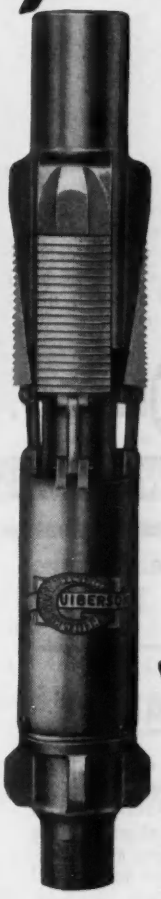
Humble Oil & Refining Company, Shell Union Oil Corporation and its Associated Companies, and Stanolind Oil and Gas Company have each established fellowships in petroleum engineering at the University of Oklahoma.

Holders of the fellowships will be candidates for the masters degree in petroleum engineering. The Stanolind fellowship stipulates that graduate research study will be carried on in the field of displacement of oil from reservoir material.

Dr. John C. Calhoun, Department of Petroleum Engineering, Faculty Exchange, is receiving applications.

Safeguard TUBING with Guiberson TUBING CATCHER

Stops the parted tubing before it falls 3 inches, without damage to casing walls. Releases easily and quickly and has large fluid and gas bypass area. Hangs free until tubing drops. Large area slips grip the casing wall firmly without distorting casing.



Reg. U. S. Pat. Off.

Type "E" Tubing Catcher

Type "B" Tubing Catcher

Two types with or without anchors for all sizes and weights of casing: Made in Type "E" with 3 slips for wells to 11,000 feet, Type "B" with 3 slips for wells to 7,200 feet.

For complete data see the Composite Catalog, pages 1528-32 or write to

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Guiberson U. S. A.

Established 1919

THE GUIBERSON CORPORATION

GENERAL OFFICES: DALLAS, TEXAS
EXPORT OFFICE: 30 Rockefeller Plaza, New York 20.
CALIFORNIA DISTRIBUTOR: W. R. Guiberson Co., 717 E. Gage Avenue, Los Angeles 1.
BRANCH OFFICES: Tulsa, Okla.; Alice, Houston, Kilgore, Longview, Odessa, and Wichita Falls, Texas; Lafayette, La.; Wichita, Kan.; Newark, Ohio.

PIEA OFFICERS—New officers of the Petroleum Industry Electric Association chosen at the 21st annual conference at Tulsa, are, left to right, front row, V. J. Sittel, Tulsa, vice president; R. M. Slough, Findlay, Ohio, president; M. H. Massey, Shreveport, secretary-treasurer; back row: W. D. Coleman, Springfield, Ill., director; A. L. Stegner, Houston, convention chairman; W. E. Church, Los Angeles, director.

Electrical Groups Conference Discusses Relation to Petroleum

The importance of electricity to the petroleum industry and new methods for harnessing this energy were discussed before an estimated 500 electrical engineers and electrical supply men at the 21st annual joint conference of the Petroleum Industry Electrical Association and the Petroleum Electric Supply Association, at the Mayo Hotel, Tulsa. The session was highlighted by a display of electrical equipment for the pipe line and other branches of the oil industry.

Speakers at the technical sessions included: Irvin Mattick, Public Information Supervisor, Southwestern Bell Tele-

HEAVY DUTY-RUGGED....

THE INDUSTRY'S LEADING CENTRIFUGE

*3480

You can maintain your required speed for the full period of the test with much less effort. Curtin centrifuges, proven world-wide, are heavy duty, rigidly constructed, and extremely simple in design. Illustrated bulletin, giving full details, available upon request.

W·H·CURTIN & CO.

HOUSTON .... NEW ORLEANS

On Mud Lines, Steam Lines Oil and Gas Lines...It's sure!

RECTORSEAL #1

Whether you are working on mud lines, steam lines, water lines or oil and gas lines on your rig, RECTORSEAL #1 can make every connection leak-proof, safe and sure! 10 years of service and industry acceptance means it's got to be good!

It's easy to apply . . . a little goes a long way. It's dependable leak prevention for life of the connection.

Ask your supply store for Rectorseal #1 by name.

Write: RECTORSEAL, Dept. D, 2215 Commerce St., Houston 2, Texas.

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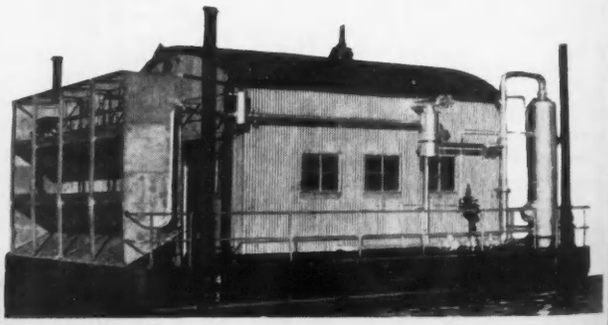
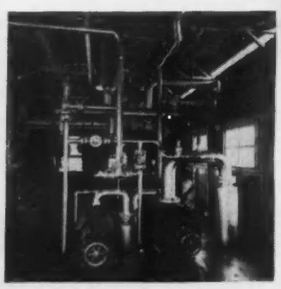
At Right — Compressor Barge being towed to location.

Below—Interior view of Barge showing compressor.





Compressor Barges for Gas Cycling or Transmission in Marine Fields

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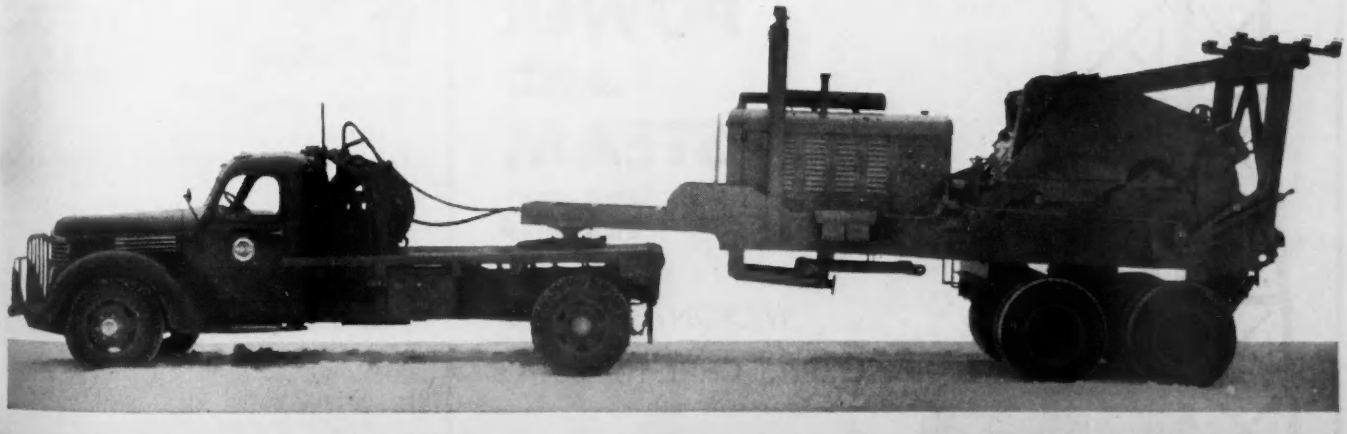
NEED A BIG WORKOVER RIG?
TAKE A MODEL L844 UNIT

SKID or TRAILER MOUNTED
One, Two or Three Drums — Air Controls

Can be furnished tandem dolly mounted unit, equipped with inverted fifth wheel for moving by lease truck or wear-plate and pin. Two pole telescoping masts up to 90′ can be mounted on this unit. Racking board, for tubing or drill pipe, and rod hangers can be furnished with the mast.

These units can be equipped with Rotary Drive, Catheads and Cross-Arm Spudder. Capacity with 52″ drum is 13,000′ of ¾″ line.

We would like to furnish you with operating data and specifications on this big Model L844



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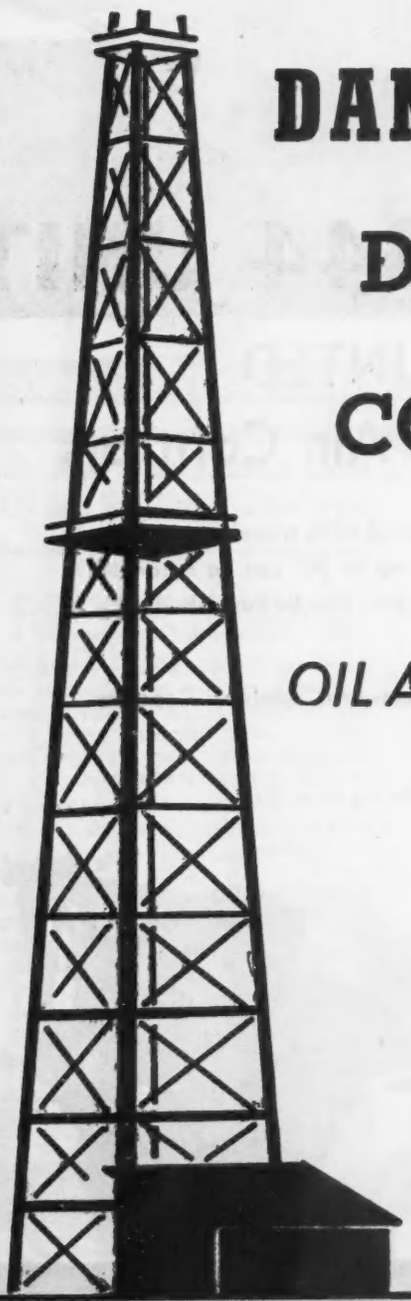
phone Company, "Midgets of Telephone Science and Service"; Ernie Upton, Minneapolis-Honeywell Regulator Company, "Special Applications of the Electronik for the Small Millivoltage and A. C. Measurements"; M. A. Hyde, Westinghouse Electric Corporation, "Electrical Equipment for Pipe Lines"; John Doremus, Communications and Electronics division of Motorola, Inc., "Supervisory Control, Teleswitching and Telemetering Equipment for Modern Systems Supervision"; Ralph G. Maddox, systems engineer, Federal Telephone and Radio Corporation, "Practical Microwave Communication for Pipe Lines"; Frank L. Kaestle, Industrial Engineering division, General Electric Company, "Electric and Gas Turbine Drives for Oil and Gas Pipe Lines"; Russell P. Northrup, assistant to general sales manager, Crouse-Hinds Company, "Interpretation of National Electrical Code and Underwriters' Specifications Applying on Explosion-Proof Electrical Equipment"; E. H. Fredrick, application engineer, Allis-Chalmers Manufacturing Company, "Let's Use the Right Induction Motor"; F. W. Littell, superintendent communications and transport facilities, Shell Pipe Line Corporation, "Report on A.P.I. Central Committee on Radio Facilities."

New PIEA officers elected are R. M. Slough, Findlay, Ohio, president; V. J. Sittel, Tulsa, vice president; W. H. Massey, Shreveport, secretary-treasurer. W. D. Coleman, Springfield, Ill., W. E. Church, Los Angeles, and A. F. Harrell, Ponca City, Okla., were named directors. A. L. Stenger, Houston, is convention chairman.

PESA officers are C. C. Mullen, Tulsa, president; M. L. Kennard, Houston, vice president; E. N. Jolliff, Dallas, executive secretary. C. A. Heiser, Dallas, is chairman of the board. W. T. Thompson and John Humber, Houston; H. L. Housley, Dallas, Ray Riddle, Tulsa and H. L. Kimsey, Oklahoma City, were named directors.

Houston was selected for next year's sessions.

DAN L. CLARK W. M. AVERILL RUPERT COX



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Cashell Becomes Penn Grade Research Committee Member

Appointment of Jack Cashell, Preston Oil Company, Columbus, Ohio, to membership on the production research advisory committee of the Pennsylvania Grade Crude Oil Association has been announced by D. T. Ring of Columbus, association president.

Cashell, a mine engineering graduate of Ohio State University in 1937, joined Preston Oil Company in 1943. His chief assignment has been development of the company's secondary recovery oil projects in Ohio, Pennsylvania, West Virginia and Kentucky.

IPAA Commends Helis For New Orleans Meeting

William G. Helis, Jr., general manager of the William Helis interests, was praised by officers, directors, and members of the Independent Petroleum Association of America for his important part in staging the mid-year meeting of the association at New Orleans May 1-3. He is a vice president of the IPAA and served as chairman of the New Orleans general arrangements committee for the meeting.

William G. Helis, Jr.

Helis was educated in southern California and England. He was manager of European operations of his father's oil interests from 1938 to 1940, served in the U. S. Coast Guard 1940-1945, and returned to inactive duty with rank of lieutenant.

Instrument Show Planned

More than 90 manufacturers of instruments and devices for measurement, inspection, testing and control, have reserved 144 booths to exhibit their latest developments at the Fourth National Instrument Conference and Exhibit at the Municipal Auditorium, St. Louis, September 12-16. The event will be sponsored by the Instrument Society of America.

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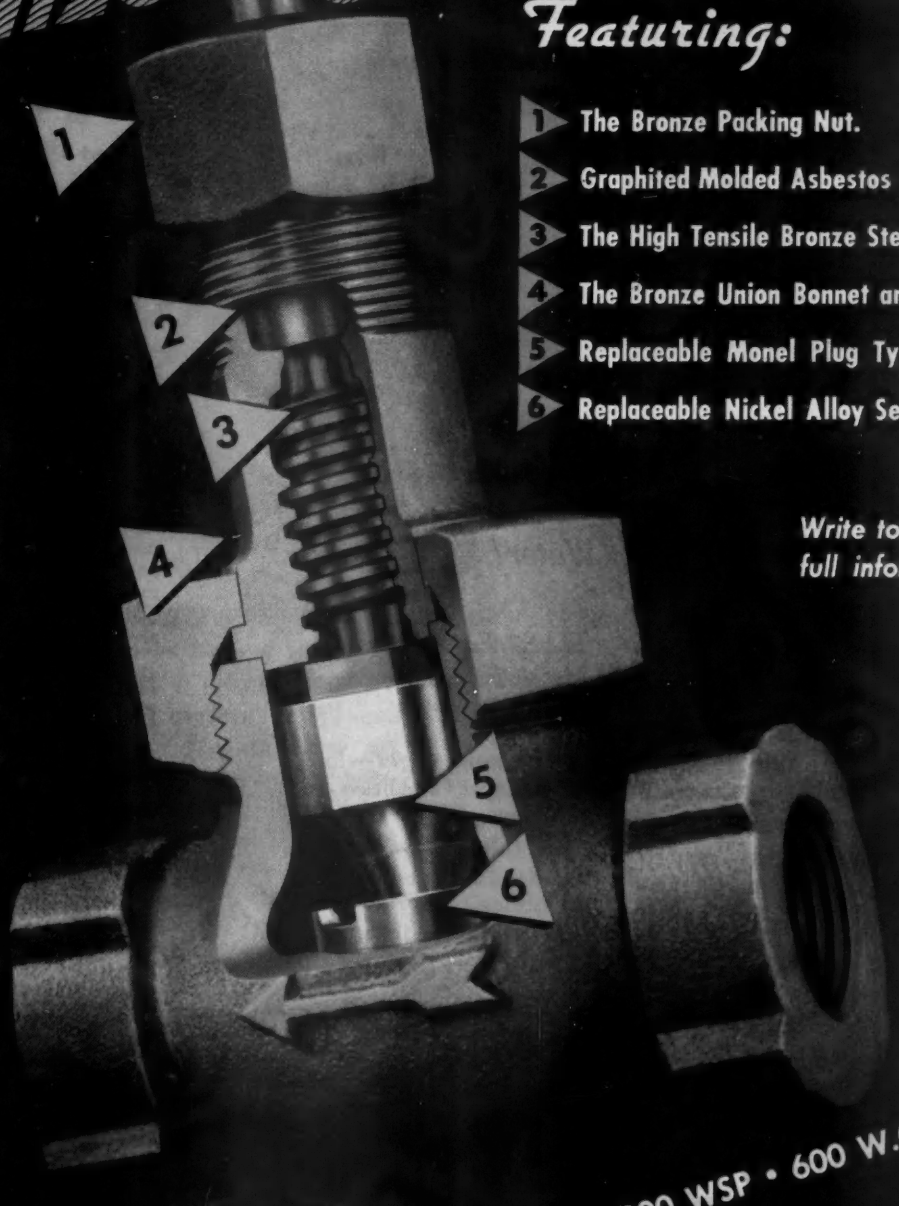
Featuring:

1. The Bronze Packing Nut.
2. Graphited Molded Asbestos Packing.
3. The High Tensile Bronze Stem.
4. The Bronze Union Bonnet and Body.
5. Replaceable Monel Plug Type Disc.
6. Replaceable Nickel Alloy Seat Ring.



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LPG Association Elects Officers at Convention

Si G. Darling, president of Darlingas, Inc., Pratt, Kansas, was elected president of the Liquefied Petroleum Gas Association at its annual convention and trade show at the Palmer House, Chicago.

Darling has been a director of LPGA for several years and has recently served as chairman of its publicity and advertising committee. He is a past president of the Kansas Liquefied Petroleum Gas Association.

Other officers named for the coming year include Edward C. McEneany, owner, Diablo Company, Walnut Creek, Calif., first vice president; W. S. Lander, owner, Rulane Gas Company, Charlotte, N. C., second vice president; Walter Miller, vice president, Dri-Gas Corporation, Chicago, treasurer; Howard D. White, Chicago, executive vice president; Frank Fetherston, New York City, vice president in charge of the technical division, and Arthur C. Kreutzer, Chicago, secretary.

More than 1500 representatives of the LPG industry from 45 states, Mexico, Canada and South America attended the sessions, setting a new record.

Officers Elected to Nomads National Board of Regents

Robert J. Eiche, president of R. J. Eiche and Associates, Inc., Los Angeles, and Fred C. Ripley, International Derrick and Equipment Company, Torrance, Calif., have been elected chairman and

Robert J. Eiche

Fred C. Ripley

secretary-treasurer of Nomads national board of regents. They succeed Henry A. Bourne and H. M. Cooley, both of Tulsa.

Eiche has traveled in all European oil producing countries, and for periods he maintained residence in both England and Roumania. He has had dealings in South American fields including Trinidad, Curacao and Aruba, and Central American countries, Mexico and Canada. He was president of the Los Angeles Chapter of Nomads in 1947 and a national regent in 1948.

Ripley spent five years in South America for Emsco Derrick and Equipment Company between 1934 and 1939, and for two years was the company's export manager. He has been manager, California Sales and Export of Ideco at Torrance since 1946.

Natural Gasoline Association Elects James Pew President

James E. Pew, vice president of The Sun Oil Company, Philadelphia, was elected president of the Natural Gasoline Association of America at the 28th annual meeting at Fort Worth. He succeeds C. R. Williams, The Chicago Corporation, Corpus Christi.

Vice presidents elected are Frank Perry, Cities Service Oil Company, Bartlesville, Okla.; T. L. Taggart, Standard Oil Company of California, San Francisco; John Lynch, La Gloria Corporation, Corpus Christi; A. H. Weil, United Gas Pipe Line Company, Shreveport. William F. Lowe, Tulsa, was reelected secretary-treasurer.

Pennsylvania College Conducts Production Research Studies

An agreement to establish a Petroleum Production Research Foundation at The Pennsylvania State College has been signed by representatives of the college and the Pennsylvania Grade Crude Oil Association, Oil City, Penn.

Purpose of the foundation is to promote development and conservation in the petroleum industry by an increase of useful knowledge of petroleum exploration and production through research and experimentation.

Bottom Water is a costly profit leak

Eagle Lead Wool

***stops* Bottom Water!**

You rule out the risk of oil-wasting bottom water shutdowns when you tamp Eagle Lead Wool in the hole. This finely stranded, non-corrosive metallic wool makes a water-tight plug that seals every crack and crevice. Comes in convenient 50-pound sacks—easy to place in special cartridge-shaped Eagle Wire Containers sized to fit all casings. Order through your jobber today.

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Eagle Outlasta—for medium speed and average-load conditions.

Eagle Durable—for low speed and light-duty conditions.

EAGLE LEAD WOOL

Seals off Bottom Water—keeps 'em flowing!

THE EAGLE-PICHER COMPANY

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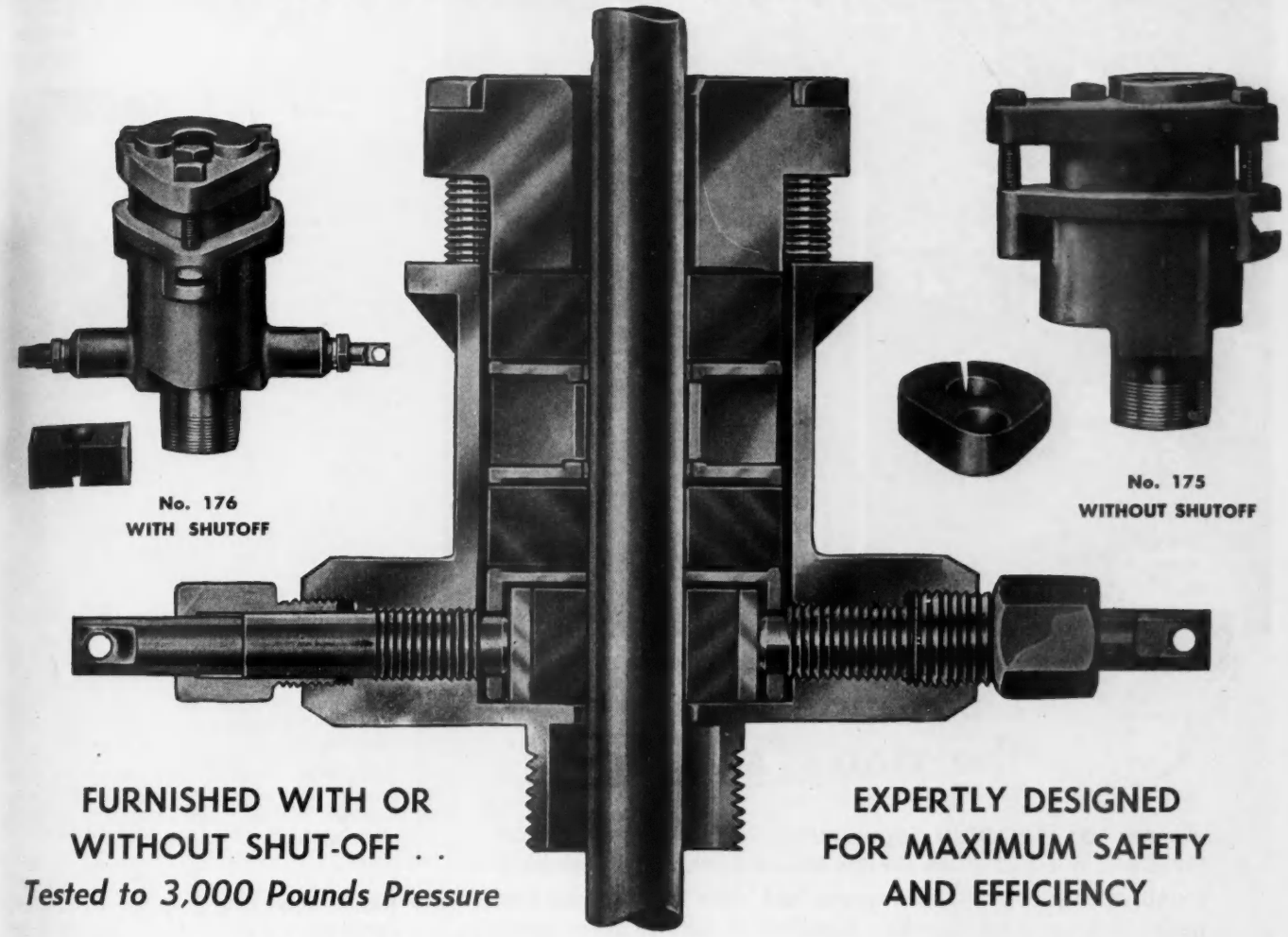
RATIGAN *Self-Oiling* STUFFING BOXES



No. 176
WITH SHUTOFF

No. 175
WITHOUT SHUTOFF

FURNISHED WITH OR WITHOUT SHUT-OFF . .
Tested to 3,000 Pounds Pressure

EXPERTLY DESIGNED FOR MAXIMUM SAFETY AND EFFICIENCY

The Ratigan No. 175 and No. 176 Stuffing Boxes are the only self-oiling stuffing boxes on the market today, receiving their lubrication directly from the pumping well.

They are excellent examples of modern design and sound engineering. Like all Ratigan Products, they are backed by many years of specialized oil field experience. Ratigan Stuffing Boxes are made of high grade electric steel and tested to 3,000 pounds pressure. The inside of the box is removable, so that the device has two oil chambers. Another arrangement inside the body keeps these two chambers filled with fluid from the well, providing positive self-lubrication without depending on the human element.

Both types are identical in design and operation except that the No. 176 (sectional view above) has a special shutoff feature which makes it possible to shut off while repacking the box. This is accomplished by tightening the screws evenly in the shutoff, although care must be exercised, as the screws must be loosened again before the well starts to pump or the fluid will not get up into the stuffing box.

When the screws are not tight against the rubber, the stuffing box is free to function properly. For a further check on the fluid coming up through the bypass, the pumper may loosen the plug in the cap a little, and if the bypass is free the oil will flow immediately. If the oil does not come through, the screws in the shutoff are too tight.

The hole in the rubber is the size of the polished rod, while the hole in the metal parts of the body is larger, making the rod self-aligning . . . an important feature.

When repacking Ratigan Stuffing Boxes, both rubbers must be renewed. Instructions for installing are supplied to oil companies and supply stores on request, and are attached to all foreign shipments. When ordering, specify size and type of thread, and size of polished rod.

For more complete information on Ratigan Pumping Equipment, consult the latest edition of the Composite Catalog.

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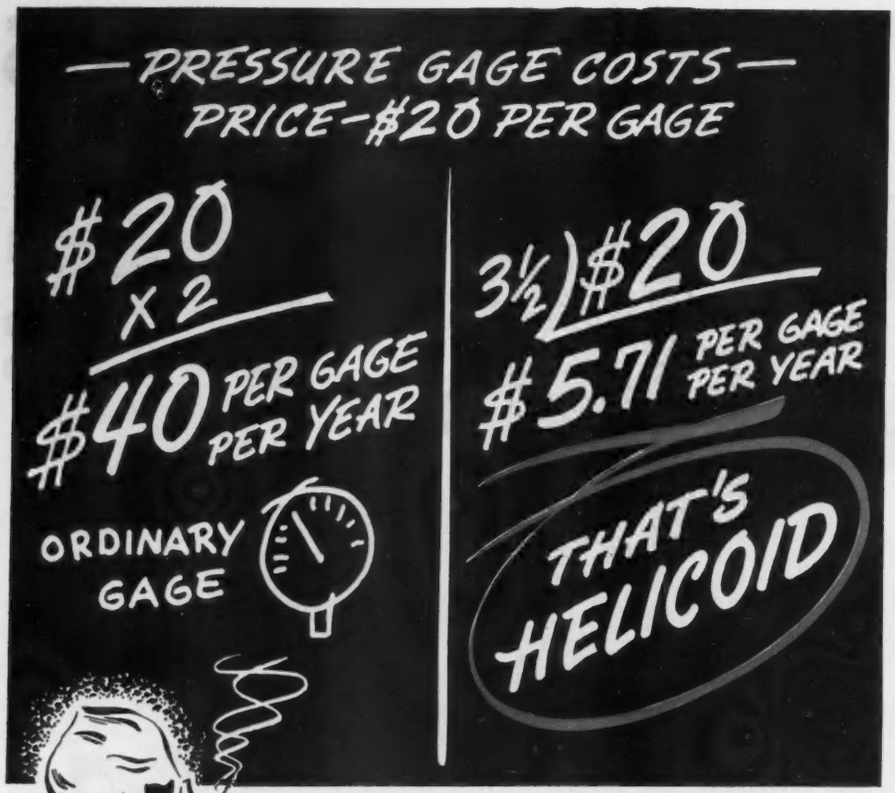
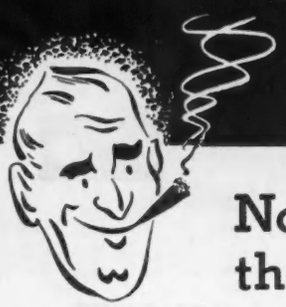




No wonder the man's "satisfied"

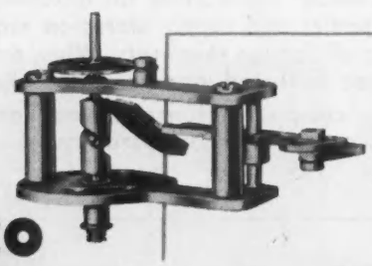
A user* of HELICOID gages wrote: "This gage gave us three and one-half years service on a Centrifugal boiler feed pump, where conventional gages had been wearing out the gears in four to six months. Needless to say we have been satisfied."

This is typical of the experiences of Helicoid gage users. They have found out how to save money.

Using a price of $20.00 for a 6" steel tube gage (and there's no premium in price for Helicoid), the cost for conventional gages would be $40.00 to $60.00 per gage, per year, in contrast to the cost of $5.71 per gage, per year, for Helicoid.

Thus, the money made by using Helicoid would be from $34.29 to $54.29 per gage per year. Send for your copy of the new Helicoid Gage catalog now.

**Name on request*



Only Helicoid Pressure Gages have the Helicoid Movement

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HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK

MEN IN THE INDUSTRY NEWS

O. F. Van Beveren has beep appointed Northern district exploration superintendent for Standard Oil Company of California, with headquarters at Bakersfield, Calif. He received a B.S. degree in geology at California Institute of Technology in 1930 and later an M.S. degree at the University of Colorado. He joined Standard in 1933 and has done geophysical work in Mexico, Java, Sumatra, Saudi Arabia and Egypt. He has been geophysical supervisor for Standard of California since 1946.

O. F. Van Beveren

»

J. Sayles Leach, Houston, was elected a member of the board of directors of The Texas Company. After graduation from Baylor University in 1915, Leach joined the company as a bookkeeper in the Dallas district office. He became traveling salesman for the company in Waco in 1917. In 1925 he advanced to superintendent of sales of the Dallas district, and in 1927 he became assistant manager of sales for the Southern area with headquarters in Houston.

He was made manager of the company's sales department, Southern area, in 1929, and he held that post until his election as a vice president in 1938.

»

Ray R. Strand has been appointed superintendent of Stanolind Pipe Line Company's Wyoming division. He succeeds H. M. Hill, who resigned to become manager of the pipe line department of Utah Oil Refining Company.

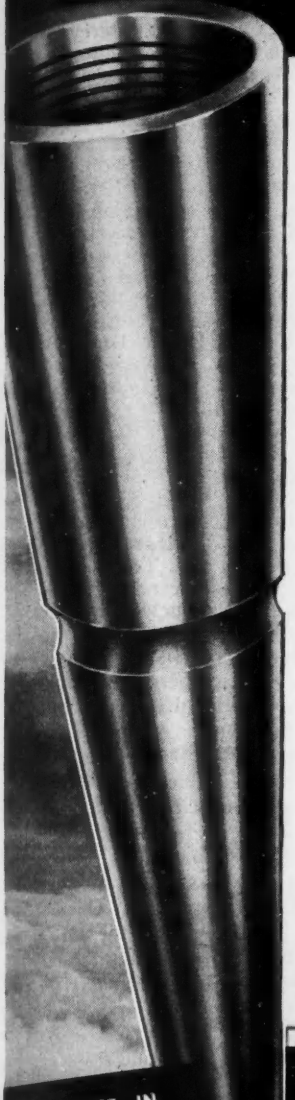
Strand, who started as a truck driver with Stanolind Pipe Line in Oklahoma in 1921, was made district foreman at Casper in 1945. He was formerly with Sinclair Oil Company.

Hobart G. Mariner, former area engineer in the West Texas division, has been promoted to assistant superintendent at Casper. After being graduated in civil engineering from Kansas State College, Mariner worked for the Kansas Highway department, Phillips Petroleum Company, and at Maracaibo, Venezuela, for Lago Petroleum Corporation. He joined Stanolind Pipe Line in 1940 as draftsman and instrument man. After serving with the U. S. Navy in World War II, Mariner returned to the company and in 1947 was made head of the hydraulics section of the Tulsa engineering department.

G. L. Maciula replaces Mariner as West Texas division area engineer. Maciula was graduated from Oklahoma A and M College in 1940. He joined Stanolind Pipe Line as an engineer in 1946, advanced to mechanical engineer in 1947, and before his recent appointment was research and development engineer.

For Offshore Drilling . . .

PRECISION DIRECTIONAL CONTROL *at low cost*



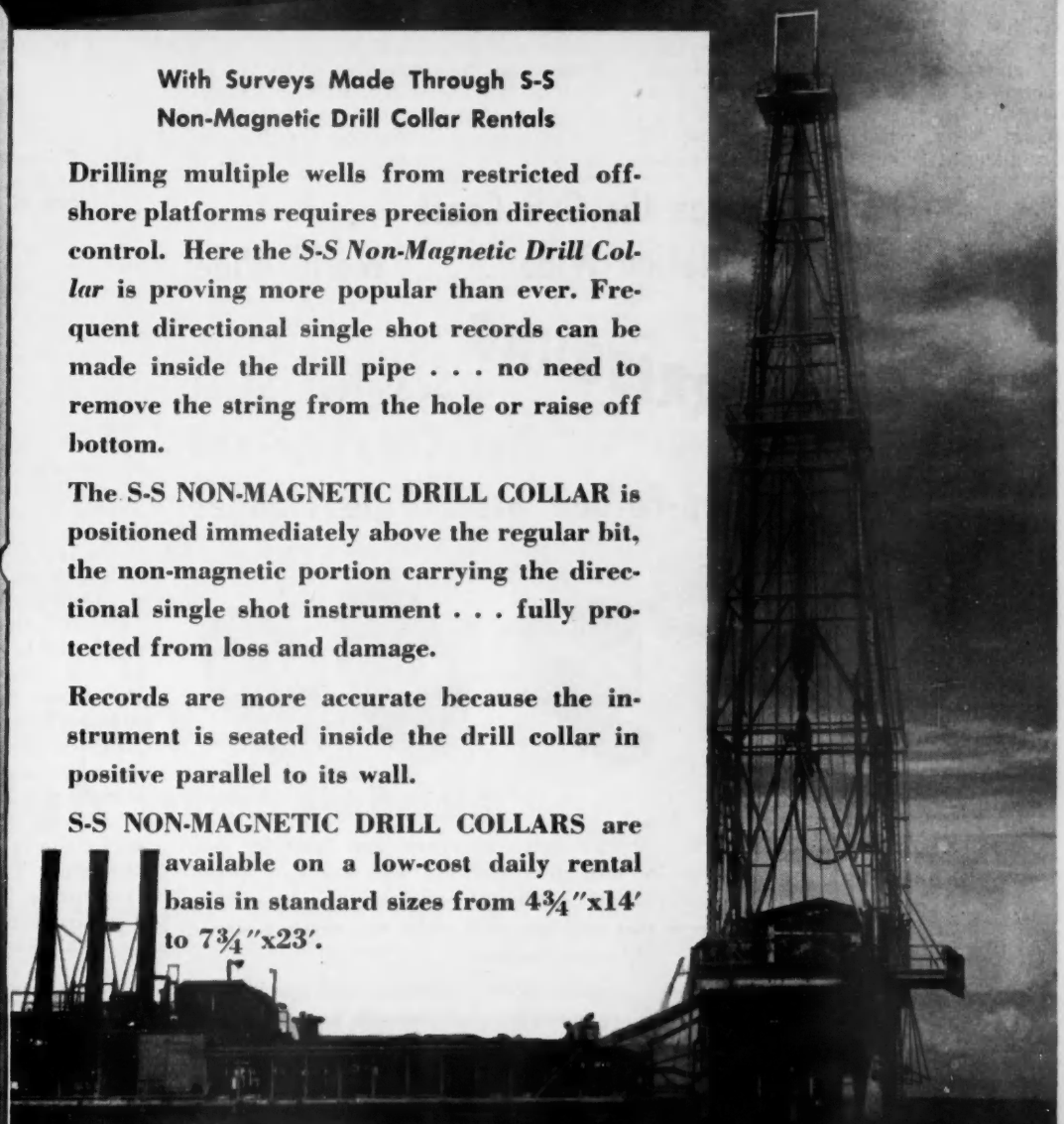
With Surveys Made Through S-S Non-Magnetic Drill Collar Rentals

Drilling multiple wells from restricted offshore platforms requires precision directional control. Here the *S-S Non-Magnetic Drill Collar* is proving more popular than ever. Frequent directional single shot records can be made inside the drill pipe . . . no need to remove the string from the hole or raise off bottom.

The S-S NON-MAGNETIC DRILL COLLAR is positioned immediately above the regular bit, the non-magnetic portion carrying the directional single shot instrument . . . fully protected from loss and damage.

Records are more accurate because the instrument is seated inside the drill collar in positive parallel to its wall.

S-S NON-MAGNETIC DRILL COLLARS are available on a low-cost daily rental basis in standard sizes from 4¾"x14' to 7¾"x23'.



LOW COST INSURANCE FOR YOUR PROTECTION. For the nominal sum of $1.00 a day renters are insured in case of loss up to ½ current sale price and ½ of accrued rental at time of loss.

In addition to single shot records it is advisable on these high-cost operations to have a permanent photographic record of the inclination and direction of the holes available with Surwel (Gyroscopic) Multishot Surveying Service.

Ask us for complete information and price list on these two services.

SURWEL SERVICE ★SYFO CLINOGRAPH ★E-C INCLINOMETER ★NON-MAGNETIC DRILL COLLAR

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Oklahoma City, Okla. Lafayette, La. Bakersfield, Calif Moulden Oil Field Services, Casper, Wyo.

Transfers and Promotions:

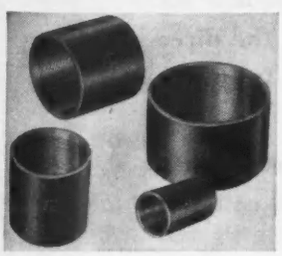
G. F. Obenhaus, field engineer for Stanolind Oil and Gas Company at High Island, Texas, has been transferred to the Beaumont district office. **J. W. Lord,** field engineer at Bishop, Texas, will succeed Obenhaus at High Island. **T. C. Storer,** formerly petroleum engineer at Alvin, Texas, replaces Lord. **W. C. Wilhite,** field engineer at Hackberry, La., has been transferred to the Lake Charles, La., district office. He was succeeded by **J. A. Couvillon,** who has been at the Lake Charels office . . . **Harry King,** scout for Continental Oil Company at Bakersfield, Calif., has been transferred to Billings, Mont. **Wade Thomas,** scout at Oklahoma City, has moved to Evansville, Ind., and will scout the Illinois Basin . . . **Earl Wooldridge** has gone to Oklahoma City from Evansville, Ind., as district landman for Continental. . . . **W. M. Wiley,** formerly assistant division manager of the North Texas division, The Texas Pipe Line Company, has been appointed division manager of the Basin system, with headquarters at Wichita Falls, Texas. **W. T. Palmer** has been transferred to Wichita Falls to replace Wiley. Palmer formerly was assistant division manager, East Texas-Louisiana division, with headquarters at Joinerville, Texas. **R. P. Tooley,** formerly district superintendent of the Dallas district, North Texas division, has been named assistant to the division manager, East Texas-Louisiana division, with headquarters at Joinerville. . . . **C. C. Book,** engineer with Republic Natural Gas Company, has been transferred to Pauls Valley, Okla. . . . **Carl Vanhooser,** superintendent for Kingwood Oil Company at Perry, Okla., has been transferred to Oklahoma City . . . **J. V. Pocock,** division safety representative for Shell Oil Company, Inc., has been transferred from Perry, Okla., to the Oklahoma City offices. . . . **Louis W. Fannell,** accountant for Sohio Petroleum Company, has been transferred from Cushing, Okla., to Oklahoma City . . . **John R. Hissom,** formerly district foreman of the Healdton Producing district, Magnolia Petroleum Company, has been promoted to assistant district superintendent with headquarters at Healdton. **Keevil L. Brown,** district petroleum engineer at Wewoka, Okla., has been transferred to production operations in the Healdton Producing district, where he will serve as production foreman at Healdton. Formerly district petroleum engineer for the Vanderbilt Producing district, **John S. Russell** has been made production foreman at Vanderbilt, Texas. **A. H. Massad,** petroleum engineer at Brownfield, Texas, has been promoted to district petroleum engineer of the Wewoka Producing district. **W. A. Daniel,** petroleum engineer at the Lake Charles, La., district, has been promoted to district petroleum engineer of the Vanderbilt district. **Thurman Pinkerton,** petroleum engineer at Falfurrias, Texas, was transferred to the Houston division office. In the Exploration division, **Harry H. Emmerich** was transferred from the Wichita, Kansas, geological offices to Dallas, where he was made research associate at the Field Research Laboratory. **R. C. Coffee,** land man, has moved to Tallahassee, Fla., from San Antonio. **Ray F. Janke** of Tallahassee, has transferred to Wichita to take charge of the Land department. **Eugene L. Fry** has moved to San Antonio from Wichita.

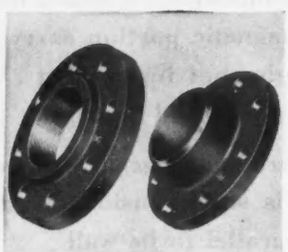
S. P. (Stu) King has been appointed resident manager for Franco Oils Limited with headquarters at Vermillion, Alberta. King was graduated from the University of Southern California in 1941. He spent the next seven years in South America as production engineer for Trinidad Leaseholds, production superintendent for Trinidad Consolidated Oilfields, and as district petroleum engineer for Creole Petroleum in Venezuela. During the past year he has been Canadian representative for Baroid Sales division of National Lead Company in Alberta.

S. P. King

OIL MEN... on the Gulf Coast . . .
Nation-Wide . . . World-Wide

PREFER HARRISBURG Seamless Steel Pipe Couplings and Drop-Forged Steel Pipe Flanges





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Harrisburg's complete line of standard and special purpose Flanges are noted for their strength, endurance, and accurate machining—meeting the most exacting requirements of field engineers everywhere. *Made to A.S.A. standards.*

Write for prices, catalogs, and data on Harrisburg products.

IN CYLINDERS . . . Harrisburg's new *Lite-Weight* Propane Cylinders—100 lbs. capacity, tare weight 72 lbs. —made to I.C.C. 4BA-240—lead the trend toward *safe*, easily transported, easily stored LP gas containers. We are the world's largest producers of Seamless Plate-Made High Pressure Gas Cylinders to I.C.C. specifications.

Distributors for Couplings, Pipe Flanges

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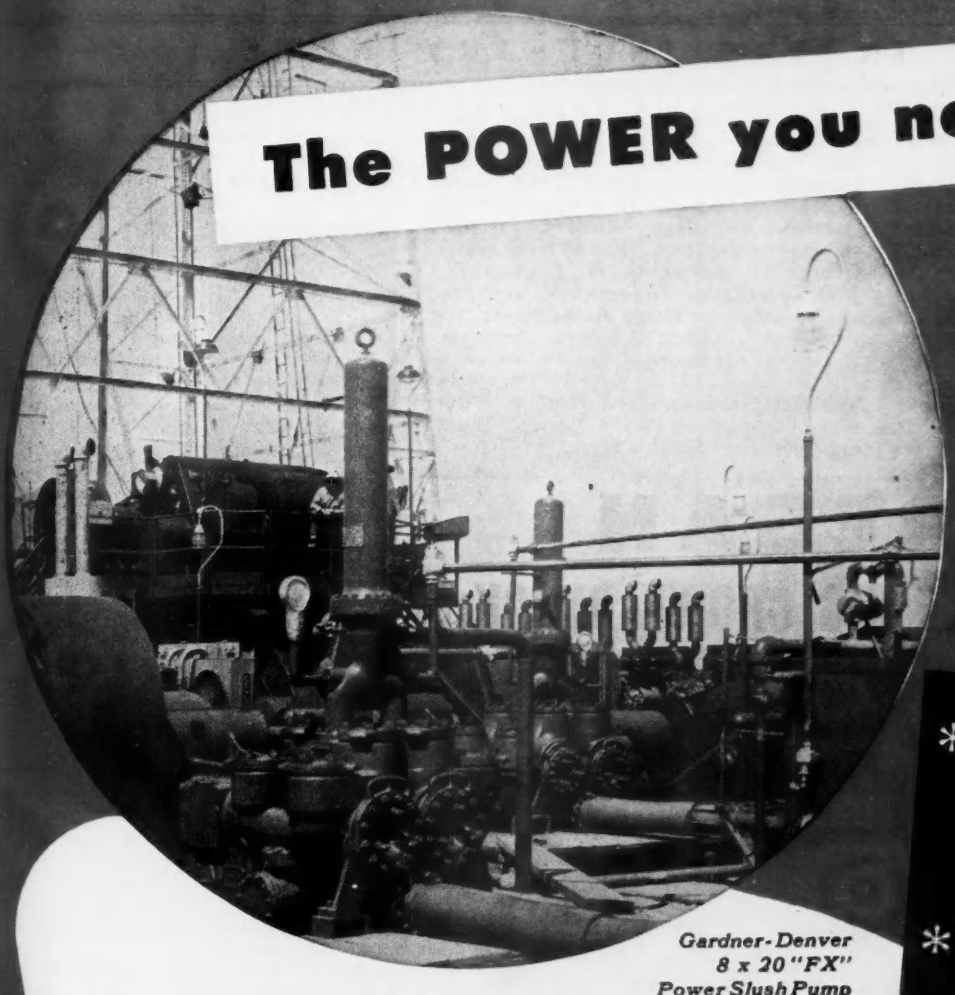
Harrisburg STEEL CORPORATION
HARRISBURG 8, PENNSYLVANIA

96 YEARS IN PENNSYLVANIA'S CAPITAL

The POWER you need...



Gardner-Denver
8 x 20 "FX"
Power Slush Pump

for heavy mud... high pressures!

That's what you get with a Gardner-Denver "FX" Power Slush Pump. And that's why experienced oil men depend on "FX" pumps for today's deeper drilling jobs. They know that heavy muds and higher pressures demand a pump with a reputation for strength and stamina. A glance at the features listed will show why Gardner-Denver power pumps have that reputation.

- Famous Gardner-Denver divided fluid end construction—cast of GarDurloy Alloy—developed especially for mud pumps.
- Rugged, one-piece double wall main frame—provides greater resistance to shock loads.
- Automatic, controlled lubrication to power end working parts; grease packed Jackshaft roller bearings have pressure gun connections outside the frame.
- Continuous tooth-type Herringbone main gear and drop forged pinion.

For complete information, write Gardner-Denver Company, Quincy, Illinois.

USE ONLY GENUINE GARDNER-DENVER PARTS

GARDNER-DENVER *Since 1859*

Dallas • Houston • Tulsa • St. Louis • Los Angeles
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Denver • New Orleans

Continental Supply Co., Continental Bldg., Dallas, Tex. Export Division: 30 Rockefeller Plaza, New York, N. Y. Republic Supply Co. (of Calif.), 2600 S. Eastland Ave., Los Angeles, Calif.

Joiner Cartwright, Beaumont, Texas, has been elected assistant secretary of Sun Oil Company. Cartwright, a member of the management committee of the Gulf Coast division of Sun's production department, joined the company's legal department after his graduation from the University of Texas in 1924. He has been general attorney of the Gulf Coast division since 1942.

»

L. H. Prichard, Sr., one of the founders of Anderson-Prichard Oil Corporation, Oklahoma City, was reelected chairman of the board of directors. Other officers who were reelected are **Roland V. Rodman,** president; **T. H. Marshall,** vice president and treasurer; **Neale Boyd,** secretary and assistant treasurer; **S. A. Garrison** and **Roy Winters,** assistant secretary-treasurer; **R. W. Brauchli, George H. Burns, C. H. Dresser** and **J. R. Lewallem,** vice presidents in charge of departments. **Hugo A. Anderson** and **Charles F. Glore,** Chicago, were reelected to the board.

»

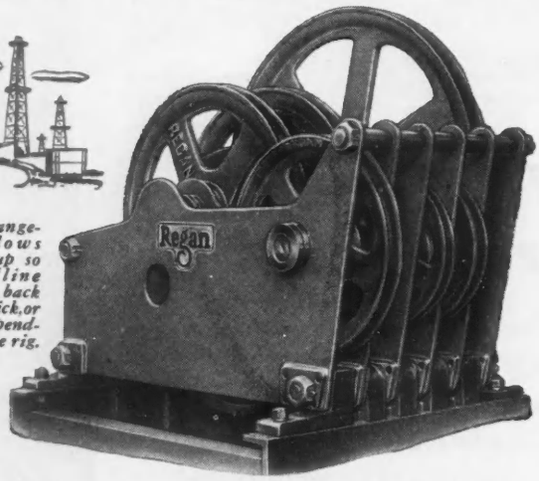
William Hurst, reservoir engineer, has moved his offices to the Bermac Building, 4101 San Jacinto Street, Houston 4.

REGAN

PORTABLE RIG CROWN BLOCK

FOR LONGER WEAR...

Adaptable to any type portable derrick, records prove Regan Portable Blocks give years of uninterrupted service and increased line wear. Features include staggered sheaves with integral pins which rotate with the sheave; dual roller bearings with individual pressure lubricator insuring maximum strength and durability with minimum time and cost of repair; and a 48" diameter sheave for the fast line. Engineered and built to Regan's high standards; 200 ton capacity.



Sheave arrangement allows stringing up so that deadline passes down back side of derrick, or on inside depending upon type rig.

SAND AND CAT LINE SHEAVES BUILT IN CROWN

This special feature permits most efficient portable rig operation.

I-PC

Regan Quality — Wrought on the Forge of Experience

Forge & Engineering Co.

SAN PEDRO, CALIF. HOUSTON, TEXAS

Exclusive Mid-Continent Representatives:
Hunt Tool Co.,
P.O. Box 1436, Houston, Texas

Exclusive Export Representatives:
Hunt Export Co., 19 Rector St., New York, N.Y.
Avda Pte., R. Saenz, Pena 832, Buenos Aires, Argentina

Chester M. Crebbs

Chester M. Crebbs, president of Mene Grande Oil Company, Caracas, Venezuela, retired May 1 after 31 years service with the Gulf companies. Crebbs began his career with the Gulf Production Company, Fort Worth, in 1918. After one year in France during World War I, he returned to the Gulf Corporation as geologist. In October, 1919, he was transferred to Mexico as geologist, and was later made chief geologist of the Mexican Gulf Oil Company at Tampico.

Crebbs first went to Venezuela in February, 1923, as general agent for the Venezuela Gulf Oil Company. When Venezuela Gulf acquired Mene Grande Oil Company in 1936, he was elected president of Mene Grande with headquarters in Caracas.

He is succeeded as president by **Hoyt Sherman,** who has served as assistant to Crebbs in various capacities since 1928, and who has been vice president of the company since 1947.

»

A. Dee Simpson, vice chairman of the board of the National Bank of Commerce of Houston, was elected to the board of directors of the Tennessee Gas Transmission Company. He fills the vacancy created by the death of **Hervey M. Amsler.**

Simpson was president of the National Bank of Commerce from 1934 until the first of this year when he took over the duties of vice chairman. He was a former president of the Houston Foreign Trade Association, and has been a director of the National Foreign Trade Council since 1934.

»

Richard Godfrey has been promoted to manager of the Production and Development department of The Bahrein Petroleum Company, Ltd. He joined the company as a petroleum engineer in September, 1937, and has been stationed at the Bahrein, Persian Gulf, oil field since that time.

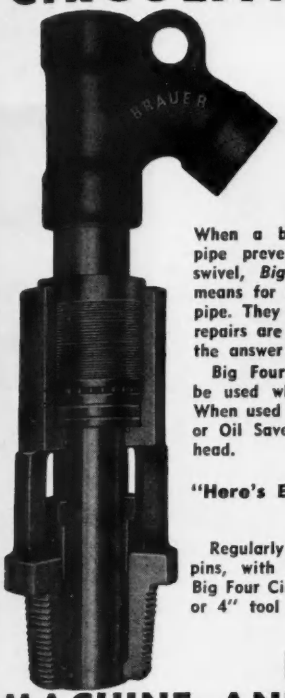
»

J. B. Lawson, formerly general superintendent of Great Lakes Pipe Line Company, has been elected vice president of operations. **R. L. Wagner,** the company's general counsel, has also been elected a vice president. Previously assistant manager of the legal department of Shell Oil Company, New York, Wagner joined Great Lakes in February. Lawson has been with the company since the early days of its organization.

»

C. Gibson, formerly district geologist for Houston Oil Company of Texas at Shreveport, has resigned and is now with the W. T. Bryant oil interests at Tyler, Texas. He was succeeded at Shreveport by **Frank C. Lytle.**

The Big Four Swivel CIRCULATING HEAD



GOOD INSURANCE AGAINST TROUBLE ON BREAKDOWNS OR STUCK PIPE

When a breakdown or the position of stuck pipe prevents connection of the conventional swivel, *Big Four Circulating Heads* provide a means for mud pumps to be connected to drill pipe. They permit circulation and rotation while repairs are being made . . . in many instances, the answer to keeping out of trouble.

Big Four Swivel Circulating Heads may also be used while coring with a wire line barrel. When used for this purpose, a Bowen Line Wiper or Oil Saver should be used in the top of the head.

"Here's Emergency Insurance You May Need Tomorrow"

Regularly furnished with 5" or 6" tool joint pins, with 3" top connection and 2¾" bore, Big Four Circulating Heads may be subbed to 3" or 4" tool joint connections with special subs.

BIG FOUR MACHINE AND SUPPLY CO.

P. O. Box 256, CLAY CITY, ILL. P. O. Box 477, PAWHUSKA, OKLA.

Manufacturers of BIG FOUR (Brauer) PRODUCTS

C & W Machine Works Company is authorized distributor for the entire state of Kansas for Big Four Machine & Supply Company (Brauer) Products. All C & W manufactured items and Big Four products are available here for distribution through supply stores.

The ULTIMATE *in* KANSAS CITY

★ PENGUIN DINING ROOM

★ ALCOVE COCKTAIL LOUNGE

★ OMAR COCKTAIL LOUNGE

★ SKY-HY ROOF

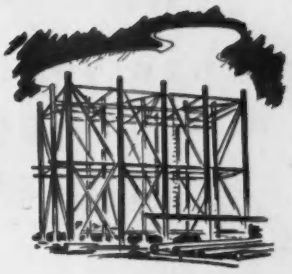
For enjoyment of living at its best; all rooms are outstandingly gay and attractive. Guests enjoy all club facilities, including the swimming pool, Turkish baths and Swedish massage. Perfect location at 11th and Baltimore.

R. E. McEACHIN
Managing Director

Direction
SOUTHWEST HOTELS, INC.
H. Grady Manning, founder

Hotel CONTINENTAL

The Story of AVONDALE and the OIL BUSINESS



Giant STEEL platforms built for offshore drilling. Write for details.

From WAR to OIL . . . Conversions of all types and sizes of craft.

Personnel and service launches built of STEEL! Speedy, efficient, rugged.

Towboats built and repaired. Marine work is our specialty.

AVONDALE MARINE WAYS, Inc.

Main Plant: Avondale, La. *Quick Repair Plant: Harvey, La.*

MAIL: WESTWEGO, LA.

Frank Leach has been elected a vice president of North American Car Corporation and will be in charge of the company's Oil Production division, with headquarters in Wichita. Leach was formerly vice president and general manager of Bridgeport Oil Company, Inc., which has been liquidated. He had previously spent 20 years with Shell Oil Company in exploitation and production, and with Hollow Drilling Company, which was merged with Bridgeport.

W. B. Hollow will have direct charge of production and drilling for North American Car. He formerly directed drilling operations for Bridgeport.

George Angle, who was district geologist for Bridgeport, has joined North American Car as geologist.

»

H. C. Smith has resigned from the Drilling department of Globe Oil and Refining Company to become production superintendent for V-T Drilling Company at Evansville, Ind.

»

Jesse K. Crownover, assistant secretary of Gulf Oil Corporation and personal secretary to the president, has retired after 41 years with the company.

Reese H. Tucker has been named chief geologist for Cities Service Oil Company (Del.) and **A. K. Wilhelm** has been appointed executive assistant in the geological department.

Reese H. Tucker

A. K. Wilhelm

Tucker was first employed by Cities Service in 1930 as junior engineer. He resigned in 1940 to form Tucker Exploration Company, which was liquidated in June, 1948, when Tucker rejoined Cities Service as manager of the geophysical section.

Wilhelm steps into the new post after almost four years as Bartlesville division chief geologist.

»

Lewis Finch, Jr., has been promoted to chief production engineer of Stanolind Oil and Gas Company, Tulsa. Finch was formerly executive assistant to **J. E. Rouse,** vice president in charge of production.

Roy H. Smith, formerly chief petroleum engineering supervisor, has been advanced to assistant to the chief engineer, Producing department. **Ralph O. Cronquist,** senior petroleum engineer, has been made assistant unitization superintendent.

Vernon C. Rosenstahl, attorney, has been made division tax commissioner for Stanolind at Oklahoma City.

Ralph W. Collins has been named division engineer for the North Texas-New Mexico division. Collins joined Stanolind as a roustabout at Midwest, Wyo., in 1936. He worked in several Rocky Mountain fields and at Stanolind's Casper, Wyo., division office before he went to Rangely, Colo., as production foreman in January, 1947. A year later he went to the Tulsa general office as a petroleum engineer and last January was made senior petroleum engineer at Tulsa.

C. L. Kelley has been made assistant field superintendent at Brownfield. Kelley, who has been senior petroleum engineer in the Fort Worth division office, joined Stanolind in 1937 at Iraan, Texas. He spent several years working at West Texas fields before he was made a petroleum engineer in East Texas in 1943. He went to Odessa, Texas, as field engineer in 1945, and was later made production foreman. He transferred to Fort Worth in 1948.

J. R. Foster has been promoted to party chief in the company's seismograph department and will work out of Minden, La.

PARAFFIN'S NO PROBLEM

when your sucker rods are equipped with

HUBER SCRAPERS

Paraffin can't accumulate in the tubing when your sucker rods are equipped with Huber Scrapers. NO PARAFFIN . . . NO TROUBLE . . . NO REMOVAL COSTS!

Huber Scrapers, shrink-fitted to new or used sucker rods, scrape paraffin from the tubing wall as the string rotates and reciprocates. This constant scraping prevents paraffin accumulation . . . eliminates paraffin removal.

Huber Scrapers quickly pay for themselves. Wells requiring paraffin removal every week or ten days have been on production for months without paraffin trouble after Huber Scrapers were installed.

If paraffin's a problem, install Huber Scrapers. Write for descriptive bulletin.

HUBER ROTATING ROD HANGER

This rod hanger rotates the rod string a fraction of a turn on each reciprocation. The horizontal teeth on the turn table are engaged by two ratchet levers which are actuated by a flexible steel cable attached to the walking beam. On each reciprocation the levers move the rod string a fraction of a turn.

SOLD THROUGH SUPPLY STORES

J. M. HUBER CORPORATION
P. O. BOX 831 BORGER, TEXAS

HUBER PARAFFIN SCRAPERS

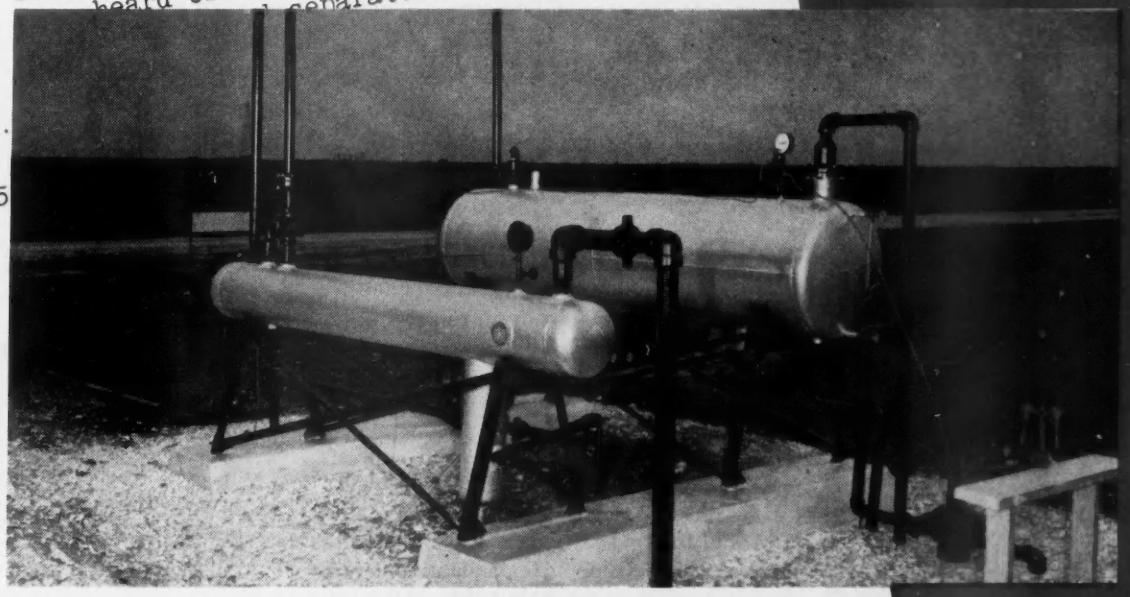
SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

TO DISTRICT SUPERINTENDENT:

Maloney-Crawford

Here's why we want horizontal separators:

1. They handle more crude than do the same diameter vertical separators.
2. They are most effective in handling foamy oils and distillate production.
3. [illegible] heard of some performance records with [illegible] separators which we can't
4. [illegible]
5. [illegible]



Mac

P.S. Also, I'm sold on Maloney-Crawford's exclusive Vane Type mist extractor.

Maximum separation efficiency has always been the keynote of Maloney-Crawford separators. All the forces of nature — gravity, centrifugal force, gas expansion, reduction of velocity, surface contact, and high velocity — are used to get complete separation of oil mists from moving gas streams. Long horizontal travel of oil and gases at reduced velocities is one of the important features leading to performance records being set with Maloney-Crawford horizontal separators. Complete range of sizes and pressures available.

STOCKS AND SERVICE AT THESE PRINCIPAL OIL CENTERS

Artesia, N. M.
Calgary, Canada*
Casper, Wyo.
Corpus Christi, Texas
Dallas, Texas
Edmonton, Canada*
Fort Worth, Texas
Houston, Texas
Lafayette, La.
Lloydminister, Canada*
New Orleans, La.
Odessa, Texas
Oklahoma City, Okla.
Pampa, Texas
San Angelo, Texas
Tulsa, Okla.
Wichita Falls, Texas

MALONEY CRAWFORD

MALONEY-CRAWFORD TANK & MFG. CO.

EXPORT REPRESENTATIVE: Baird Lines, 420 Lexington Avenue, New York
*CANADIAN REPRESENTATIVE: Dominion Oil Field Supply Co., Calgary

38 North Peoria | Box 659 | Tulsa, Oklahoma

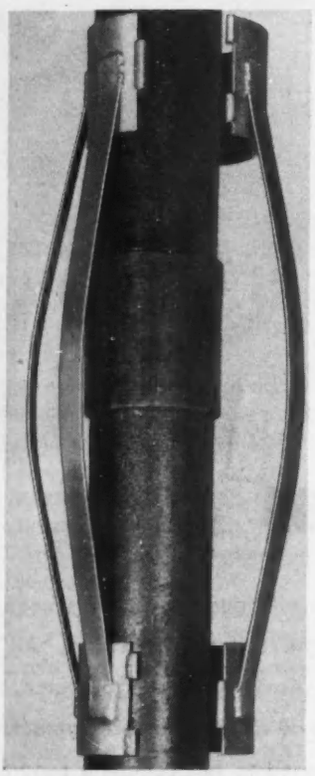
H. T. Earl, H. B. Haney, R. K. Kelly, G. R. Kinter and **J. E. Roth** have been appointed vice presidents of Tide Water Associated Oil Company. Each of the new vice presidents has heretofore served as an assistant vice president of the company.

Earl is in charge of purchases and exchanges of crude oil and products required to supplement the production of the company's Western division. He has been continuously employed by the company and its former subsidiary, Associated Oil Company, for more than 45 years.

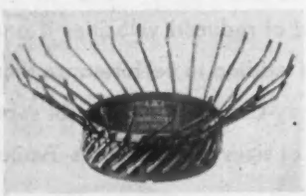
Haney, manager of transportation of the Western division, is in charge of all marine, pipe line, traffic and automotive activities of that division. He has a service record of more than 32 years.

Kelly is a graduate of the U. S. Naval Academy at Annapolis. He served for twelve years in the Construction Corps of the Navy and in 1936 he resigned from the Navy to enter the employ of Tide Water Associated Oil Company. Soon thereafter he became manager of marine operations of the company's Eastern division. He served as assistant director of transportation for PAW.

Insure Better Cement Jobs *BEFORE* Cementing!



B and W Latch-On Centralizer



B and W Multi-Flex Scratcher

IT'S EASY TO KNOW ahead of time that you're going to get a better cement job... that you'll avoid need for squeeze cementing... that you'll have a more profitable well completion—*and at just a fraction of the cost of having a cementing failure on your hands!*

First—*Centralize the casing* with simple, easy-to-install B and W Latch-On Centralizers. Effective casing centering eliminates channeling in the cementing zone and insures the best possible cementing bond between casing and hole wall. Latch-On Centralizers are of split hinge construction to permit quick, money-saving installation on either collared or external upset casing, and are made in straight and spiral types for all well conditions.

Second—*Remove mud cake* with B and W Multi-Flex Scratchers installed on the casing through the desired cementing area. Strong multiple-wire fingers 5" long combine strength with reversibility... are flexible to adapt themselves to hole contour for minimum disturbance of the mud cake while running in... insure *complete mud removal* during cementing.

We'll gladly supply full information on how you can use this B and W equipment for better well completions. Write today.

Don't Squeeze! ...it CAN be avoided

B and W Incorporated

★ *Well Completion Specialists* ★

305 M & M BLDG., HOUSTON 2, TEXAS • 3545 CEDAR AVE., LONG BEACH 7, CALIF.
Export Representative: Champion & Smith, Inc., 617 So. Olive St., Los Angeles 14, Calif.
10 Rockefeller Plaza, New York 20, N. Y.

Kinter has been vice president of the company's subsidiary, Tidal Pipe Line Company, since 1934. He has been manager of the Mid-Continent division's manufacturing department since 1937.

Roth was first employed by the company in 1924. He became chief production engineer in the company's Mid-Continent division in 1938 and production manager of the Mid-Continent division in 1940.

»

Henderson Supplee, Jr., director and vice president of The Atlantic Refining Company, has been elected to the newly created post of executive vice president. **Hugh W. Field,** board member and manager of the Research and Development department, was elected vice president.

New directors of the company elected at the annual stockholders' meeting are **Dwight T. Colley,** elected for a two-year term, and **P. G. Wharton,** vice president, named for one year. Colley was also elected vice president and was named general manager of domestic sales.

»

Albert and **Arthur Finston,** formerly with Bell Oil and Gas Company, have opened an office in the Mayo Building, Tulsa, and will engage in the oil business as Finston and Company.

»

P. B. Wolfe, formerly with Sinclair-Wyoming Oil Company at Midwest, Wyo., is now with Sinclair Prairie Oil Company stationed at Cromwell, Okla.

»

Carl H. Zwick has been named assistant land man for Sunray Oil Corporation in the Tulsa offices. Zwick was formerly associated with Henshaw Brothers, drilling contractors and producers, San Antonio, and recently was a land man for Shell Oil Company, Inc., in Oklahoma City.

»

John L. Copeland has been made district superintendent of the Magnolia, Ark., district for Interstate Oil Pipe Line Company, succeeding the late **T. F. Welch.**

»

D. R. Welch, Tulsa, has retired as superintendent of communications of Sinclair Refining Company after 32 years service with the company.

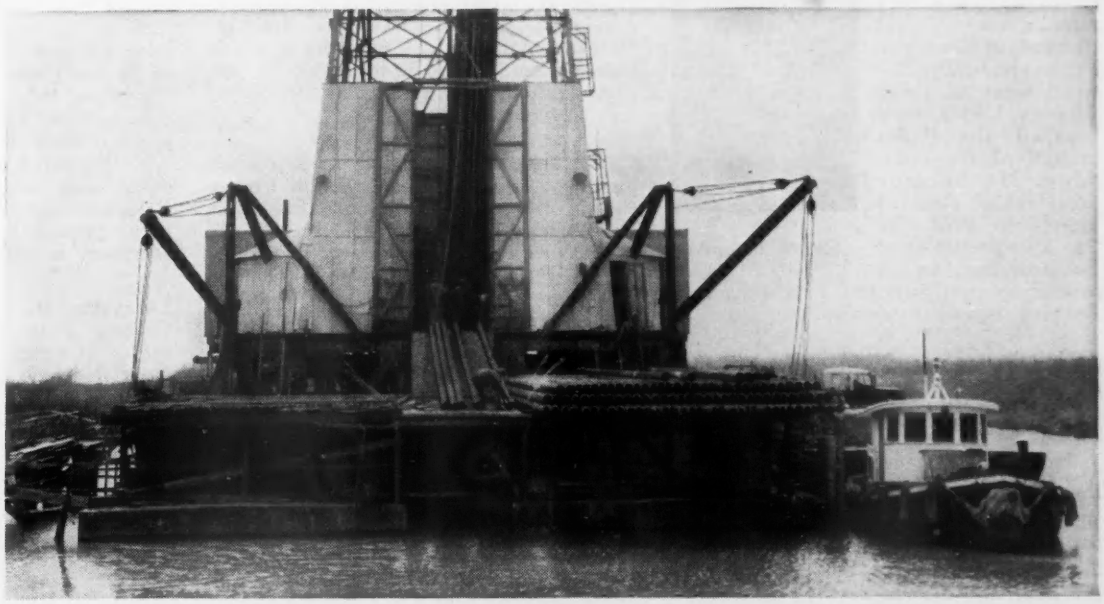
»

Robert H. Ausfahl of Standard Oil Company of California has received one of the ten Sloan fellowships to study for a year at the Massachusetts Institute of Technology. A senior analyst in Standard's department on Organization, Ausfahl will study management, economic and social problems of industrial administration.

»

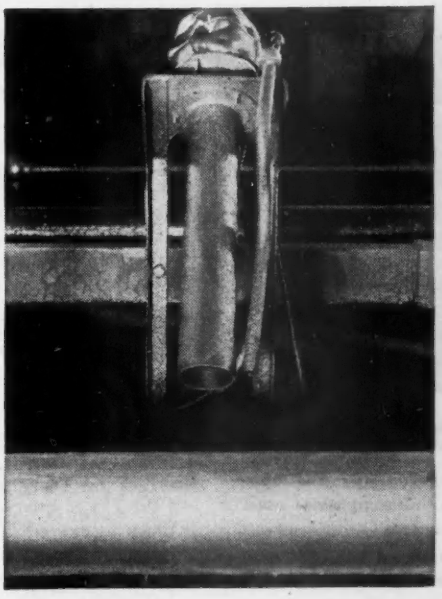
Lt. Colonel Earl R. Chase, QMC, U. S. Army, for several years chairman of the Resources Section, Armed Forces Petroleum Board, Washington, D.C., has been transferred to Camp Lee, Virginia, where he will serve on the staff and faculty of the Quartermaster School.

DEPENDABILITY THROUGH



IN A SOUTHERN FIELD: A 10,000-foot string of 7-inch S-80 and S-105 SMITHway Casing being run in the bayous of Louisiana.

RESEARCH AND ENGINEERING



IN THE A. O. SMITH PIPE MILL: This equipment is used for measuring and controlling Casing temperature for certain manufacturing processes.

A.O. SMITH way 75th ANNIVERSARY 1874 1949

SMITH*way* CASING · LINE PIPE

A. O. SMITH CORPORATION

New York 17 • Pittsburgh 19 • Atlanta 3 • Chicago 4 • Tulsa 3 • Dallas 1
Houston 2 • Seattle 1 • Los Angeles 14 • International Division: Milwaukee 1

DEATHS

W. M. Bovaird, 58, president of the Bovaird Supply Company, died April 26 in Tulsa. Nationally known in the oil well supply business, he was the third generation connected with the company founded by his grandfather, David Bovaird, in Bradford, Penn., in 1897. Bovaird went to Tulsa about 1913 and founded the Tulsa branch of the company. He became president of Bovaird Supply in 1928. He was also president of Bovaird, Inc., an oil producing company and a subsidiary of Bovaird Supply Company.

W. M. Bovaird

»

Chauncey R. Boling, 61, southwest division manager of the J. J. Linn Oil Exploration Company, died April 22 in Tulsa.

»

Patrick W. Hennessy, 66, formerly superintendent of The Ohio Oil Company's Casper, Wyo., Pipe Line division, died April 9 in Casper. He had been with the company 38 years when he retired in 1945.

»

J. Warren Burgess, Tulsa, independent oil operator who helped to develop the Berryhill pool near Red Fork, Okla., died April 18.

James B. Huff, Jr., 56, Houston independent oil man, died May 2 in Houston. Before entering the oil business as an independent, Huff had served as assistant secretary-treasurer of the United Gas Company.

»

Calvin James Dean, 50, senior petroleum engineer for General Petroleum Corporation, died May 9 at South Pasadena, Calif. Dean joined General in 1923, and in 1925 was made an assistant geologist in Los Angeles. He moved to Bakersfield the following year, and worked there for six years as a geologist and petroleum engineer. In 1941 he returned to the company's headquarters in Los Angeles.

»

James P. Koons, 70, retired pipe line technician for Mid-Continent Petroleum Corporation, died April 7 in Tulsa. He had been with Mid-Continent for 31 years before his retirement two years ago.

»

J. W. Culbertson, 74, one of the developers of the Petrolia gas field in Texas, died May 5 at Wichita Falls, Texas. Culbertson operated a gas system in Wichita Falls from 1909 until 1918 when he sold his franchise to Lone Star Gas Company. He went to Texas in 1909 from Pennsylvania.

C. Neal Barney, 73, secretary and general counsel of Worthington Pump and Machinery Corporation, died in Scarsdale, N. Y., April 24. Barney was graduated from Tufts College in 1895 and took his law degree at Boston University. He joined Worthington as chief counsel and secretary in 1918, was appointed secretary-treasurer in 1932, and was elected vice president and secretary in 1942.

C. Neal Barney

»

Lafayette D. Lytle, vice president of Coastal Petroleum Company, and director of publicity of Coastal Oil Company, Newark, N. J., died at Plainfield, N. J., April 27. Lytle was with Barber Asphalt Company for 35 years before his retirement as general sales manager in 1942. He joined Coastal Oil Company in May, 1943. During the war, he served as consultant to the Army Ordnance department.

»

Walter J. Bahan, 49, Texas and Oklahoma oil man, died April 21 in Fort Worth. He was a partner in Bahan Brothers, oil producers, vice president of Guthrie Gas Utilities Company and vice president of the Kingfisher Gas Company in Oklahoma.

»

Richard R. Crandall, 47, consulting geologist, died April 16 at Pasadena, Calif. After graduation from Stanford University in 1923, Crandall was associated with General Petroleum Corporation and The Texas Company. For the past 20 years he had been engaged in consulting work.

»

George W. (Dub) Hall, 36, vice president of Weatherford Oil Tool Company, Inc., Bakersfield, Calif., died April 10 in a plane crash in western Wyoming. Hall started work as a roughneck at Santa Fe Springs, Calif., joined The Superior Oil Company in 1935, and served in California and New Zealand. He was a tool pusher for Superior when he resigned in 1947 to become manager of field operations for Weatherford Spring Company. He went to New Zealand as a driller during World War II, and since that time had worked principally in the Gulf Coast, Rocky Mountain, and California oil fields.

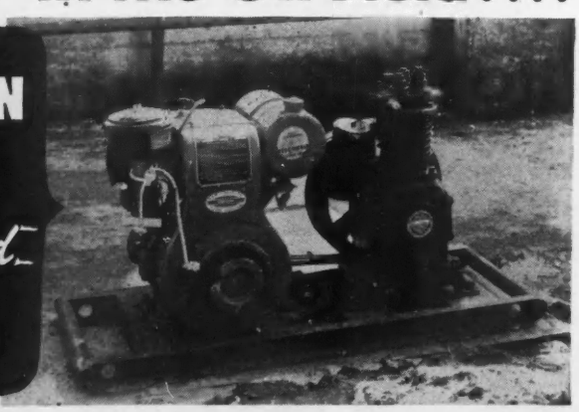
George W. Hall

»

W. J. (Uncle Billy) Stewart, 89, who had been active in the oil industry for 70 years and had been honored as "Tulsa's grand old man" at the International Petroleum Exposition of 1936, died April 8 in Tulsa.

"LIFE LINE" in the Oil Field!...

WISCONSIN HEAVY-DUTY Air-Cooled ENGINE...



Provides Starting Air For Pumping Unit!

Pumping units turn over only when starting air is adequate and unfailingly available . . . which is why a Wisconsin Heavy-Duty Air-Cooled Engine powers this compressor used to start a pumping unit for a major oil company at Magnolia, Arkansas.

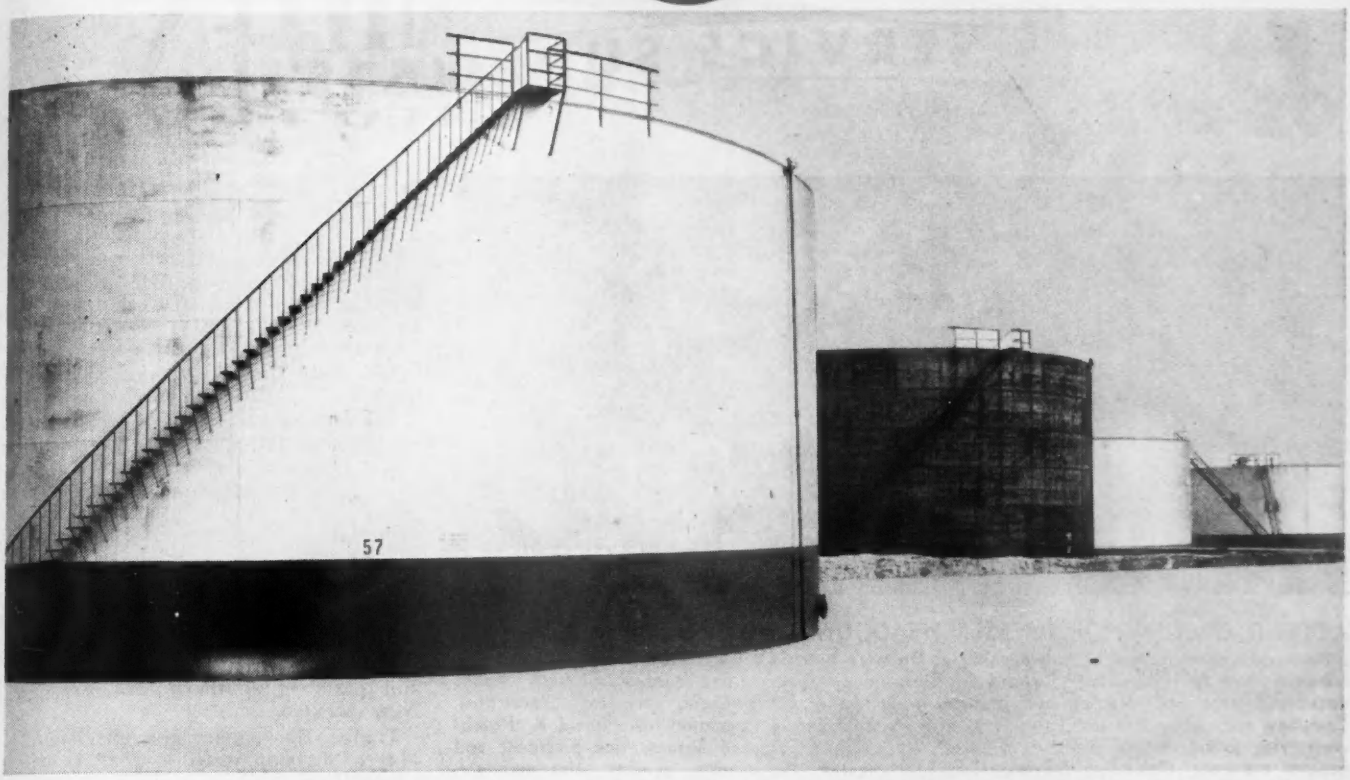
Wisconsin Engines have a broad reserve of power at ALL speeds, assuring the user that peak horsepower will always be delivered. Tapered roller bearings at BOTH ends of every drop-forged crankshaft absorb ALL thrusts throughout the entire r.p.m. range. Every Wisconsin is air-cooled by a flywheel fan in temperature as high as 140°F., while smooth sub-zero weather starting and running is assured by a magneto with impulse coupling, located OUTSIDE the engine for easy servicing.

4-cycle, single, two-, and four-cylinder types, 2 to 30 hp.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

ANOTHER 3M COMPANY SERVICE



TEXAS SOUR CRUDE HOLDERS—The interior of a McElroy Pool storage tank, similar to these and treated with "Coro-Gard" was sound, the coating intact after more than 2 years of sour crude handling.

"Coro-Gard" for lasting protection...non-stop production

What's the BIG difference between "Coro-Gard" and other plastic protective coatings? It's the compounding, which has succeeded in giving "Coro-Gard" long-lasting resistance to the solvents in petroleum—solvents which cause other coatings to embrittle, lose adhesion.

So, more and more, petroleum production men turn to "Coro-Gard" to combat corrosion inside and rust outside of equipment.

"Coro-Gard" does the job, does it well, does it longer than any other plastic anti-corrosion coating. Use it to cut oilfield equipment maintenance costs.

WRITE TODAY for complete information about cutting the cost of treating equipment, prolonging the interval between coating and re-coating. Address our Adhesives and Coatings Division in Detroit.

CORO-GARD BRAND ANTI-CORROSION COATING

Made in U.S.A. by MINNESOTA MINING & MFG. CO.
General Offices: St. Paul 6, Minnesota
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Also makers of "Scotch" pressure-sensitive tapes, "Underseal", "Scotchlite", "3M" Abrasives, "3M" Adhesives.

General Export: DUREX ABRASIVES CORP., *New Rochelle, N. Y.*
In Canada: CANADIAN DUREX ABRASIVES LTD., *Brantford, Ontario*

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

ATTEND OPENING OF DRESSER HEADQUARTERS—Industry leaders and Dresser officials who were present at the opening of Dresser's new Gulf Coast headquarters at Houston included, left to right, (top) Richard R. Bloss, vice president and general manager, Texas division, International Derrick and Equipment Company; C. P. Clark, president, Clark Bros. Company, Inc.; Otto Hammer, president, Security Engineering Company, Inc.; David K. Hutchcraft, vice president and director of sales, Clark Bros.; Ferguson Barnes, vice president and general manager, Columbus division, IDECO; (lower) F. W. Laverty, general sales manager, Clark Bros.; Robert M. Cook, vice president, Security Engineering; Warren S. Bellows, president, W. S. Bellows Construction Corporation, and president of the Houston Chamber of Commerce; Thelmon D. Collins, vice president, IDECO Supply Stores division; Oscar M. Havekotte, president and general manager, IDECO, Cleveland, O.; and R. G. Ralph, Mid-Continent division manager, Kobe, Inc., Oklahoma City.

Prompt Attention Given to Foreign Orders

"THE LUSTROUS SEVEN STAR BEAUTY"

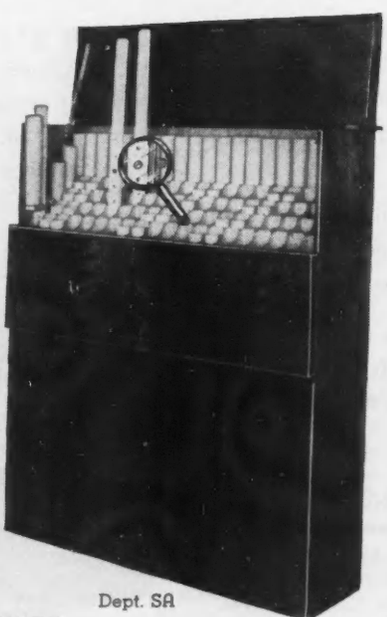
World's Best Map Filing Cabinet

• CONVENIENT • INSTANT REFERENCE • SPACE SAVER • INSTANT FILING • DUST PROOF • RUST PROOF • MEDDLER PROOF

Ultra Attractive fits the furniture scheme of any office.

Instant Adjustment—for maps or tracings from 12" to 54" long. Each Well 2" x 2", equipped with individual wood slide with holes on 2" centers, through which one screw when matched to hole in adjustment block and tightened, automatically gives perfect alignment at top for all length maps. Substantial lock—Individually keyed.

Exterior of cabinet made of ¾" five ply beautiful grained hardwood mitered locked joints, banded edges on door and top. Interior partitions ⅜" thick, and ¼" slides, all three ply veneer of southern hardwood or fir.



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Capacity	Width	Height	Depth	Price
60 "	29¾"	57"	13¾"	$107.25
75 "	36⅜"	57"	13¾"	123.75
100 "	47⅞"	57"	13¾"	140.25
160 "	47⅞"	57"	20¼"	183.75
200 "	59½"	57"	20¼"	217.25

All prices are F.O.B. Houston, Texas. Delivery: From ten to thirty days.

Finished: Walnut, Oak, Mahogany, Olive Drab Green, Natural or Blond. Other type cabinets designed to suit your needs. Information on request.

We specialize in Drafting Boards, Light Tables and other types of cabinets, made to your specifications.

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Dresser Industries Opens Houston Division Offices, Service Depot

Official opening of Dresser Industries, Inc., new division offices and service depot at 1619 Ovid Street, Houston, was attended by more than 600 guests and Dresser officials May 13.

The new structure contains 6000 square feet of office space and 14,000 square feet of warehouse facilities.

The new headquarters will be the Gulf Coast headquarters for Dresser Industries, Inc., of Cleveland, and five of its oil and gas equipment manufacturing subsidiaries: Clark Bros. Company, Inc., International Derrick and Equipment Company, Security Engineering Company, Inc., Pacific Pumps, Inc., and Kobe, Inc. These Dresser firms will service all of Texas (Panhandle excepted), Louisiana, Mississippi, Alabama, and parts of southern Oklahoma and New Mexico.

Under the supervision of Fred H. Hayes, division manager at Houston, Clark Bros., will maintain a service and parts department.

IDECO will use the headquarters for office facilities in this area only, there being no contemplated changes in service or supply from that previously established for the Gulf Coast area. Louis R. Spencer will serve as district manager of the IDECO Stores division, and R. A. Feemster, technical service representative, will be in charge of the Gulf Coast area for the Machinery and Export division. Feemster will also serve as liaison official with Mid-Continent Supply Company, Republic Supply Company, and the IDECO Supply Stores division.

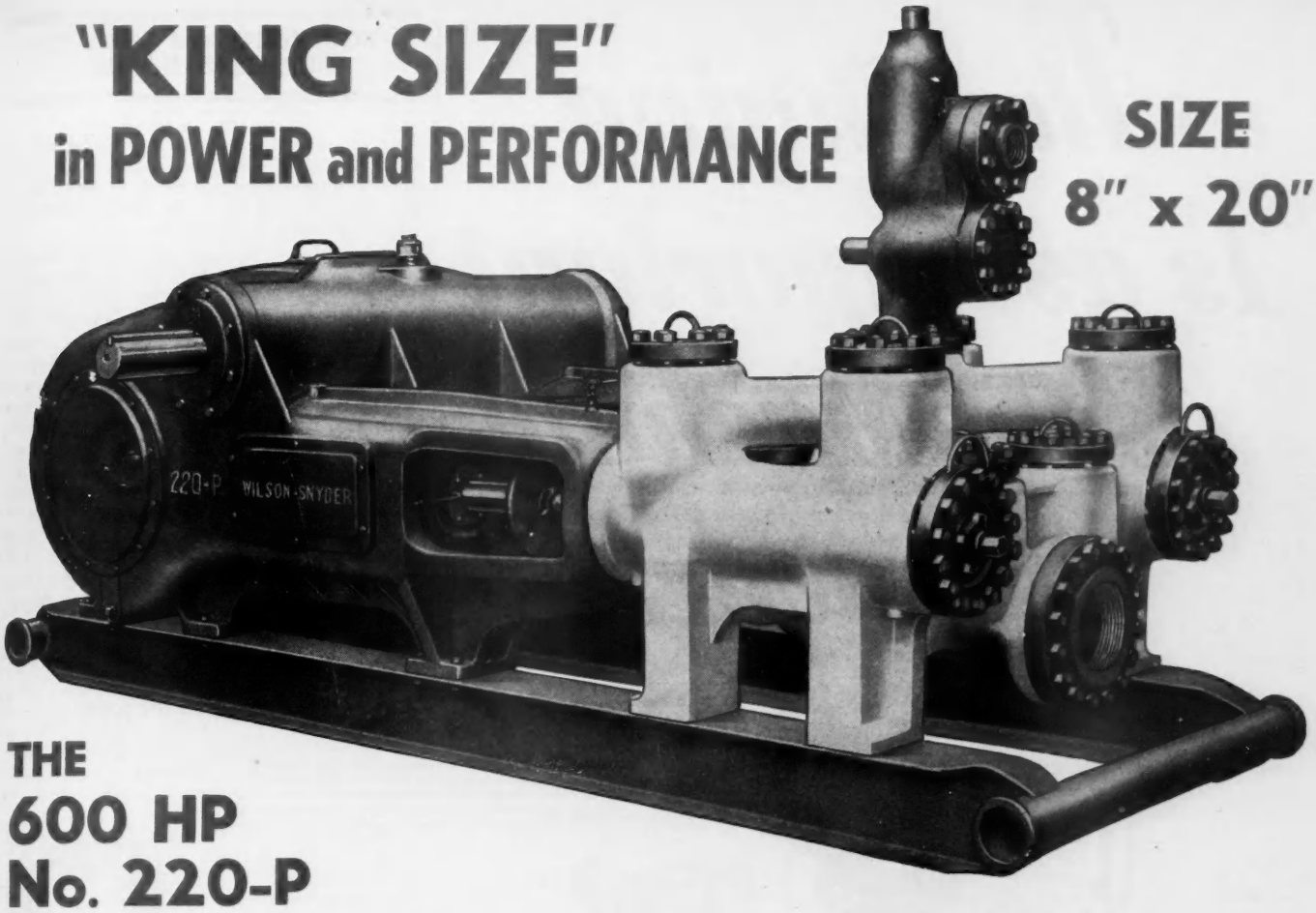
Under the direction of John W. Stewart, Gulf Coast manager, Security Engineering Company's service will cover an area from Falfurrias north to San Antonio, and the Houston area north of Conroe. Service will also include East Texas, North and South Louisiana, Mississippi and Alabama. Security engineering also has branches at Falfurrias, Texas, and Lafayette and Houma, La.

Pacific Pumps will service Louisiana and that part of Texas south of Cochran, Hockley, Lubbock, Crosby, Dickens, King, Knox, Baylor, Wilbarger and Wichita counties. Wendell R. Carlson, Houston division manager for Pacific, Centrifugal Pump division, said his firm will not maintain warehouse facilities or stock centrifugal pumps or parts at the new Houston address, this serving mainly as a Gulf Coast office. Pacific oil well plunger pumps are distributed and serviced by Republic Supply Company.

District Manager C. B. Buchner of Kobe said his firm will maintain district headquarters for the Gulf Coast territory from New Orleans to Brownsville, Texas. In addition, Kobe will maintain a sub-office at Corpus Christi under the supervision of A. R. Tullos, district representative. P. N. Wilson,

"KING SIZE" in POWER and PERFORMANCE

SIZE 8" x 20"



THE 600 HP No. 220-P

WILSON-SNYDER POWER SLUSH PUMP

Here is a Power Slush Pump built for the heavy duty work that present drilling demands. It has a greater capacity and a greater horsepower.

Naturally it is larger and more powerful.

Some of the many Wilson-Snyder features found in the No. 220-P are: (1) single helical gears with shafts set in adjustable tapered roller bearings, (2) oil bath lubrication, (3) grease lubricated crosshead pin bearings, permitting lubrication without shutting down, (4) special arrangement of the diaphragm packing and the mud baffle (5) deep stuffing boxes, designed for rod lubrication, (6) Die-Hard Liners with Tell-Tale Liner Packing and Heavy Duty Liner Spacers with outside adjustment, (7) Heavy Duty Fluid Valves.

Maximum Fluid Cylinder Liner Bore x Strike	inches	8 x 20
Rated Working Pressure of Fluid Chamber Discharge	p.s.i.	4000
Maximum Working Pressure with Full Size Liner	p.s.i.	880
Rated Speed Full Size Liners	r.p.m.	60
Theoretical Capacity (Piston Rod Deducted) at Rated RPM	g.p.m.	990
Recommended Brake Horsepower	b.h.p.	600

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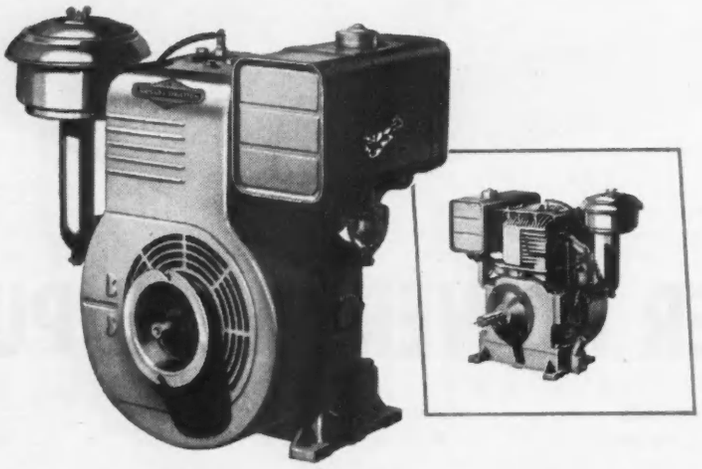

It's not enough for a machine or appliance to be skillfully designed, carefully made, and expertly assembled. It has to be *powered* right, too — with the kind of power that will insure the best performance possible year after year.

That's why it will pay you to insist on Briggs & Stratton engines — recognized the world over for dependable 4-cycle, single-cylinder, air-cooled power.

No other engines in the field can assure you such efficient, dependable, low-cost performance. No other engines have satisfied so many customers. No other engines are so universally preferred by manufacturers, dealers, and users alike.

BRIGGS & STRATTON CORP., Milwaukee 1, Wis., U.S.A.

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
Preferred Power
FOR INDUSTRIAL CONSTRUCTION RAILROAD AND FARM EQUIPMENT

EQUIPMENT and SERVICE SUPPLIERS' NOTES

field representative, will be stationed at Goliad as assistant to Tullos. Directly aiding Buchner in the eastern portion of the district will be J. M. Ward, district representative at Houston.

Kobe stocks will be carried at Houston to support installations in the Gulf Coast area, one of four districts in Kobe's Southern sales area under the management of R. E. Elner at Fort Worth. The other three Kobe districts are at Odessa, Texas, with J. T. Lewis as district manager of service in the southern half of West Texas; at Brownsville, where K. K. Snedeker is district manager of service for the north half of West Texas; and at Longview, Texas, where J. T. Lanhan is district manager.

Dresser Manufacturing Division will continue to occupy its office at 1121 Rothwell Street in Houston. This office is under the direction of District Manager Elton E. Peavy.

Schlumberger Appoints Stratton Rocky Mountain Area Manager

Everett F. Stratton, for the past four years exploitation manager, Schlumberger Well Surveying Corporation at Houston, has been made manager of the company's Rocky Mountain area. From headquarters in Denver, he will supervise operations in Colorado, Montana, Wyoming, Utah, New Mexico and the Dakotas.

Everett F. Stratton

Stratton was graduated from DePauw University in 1928 with an M. A. in geology, and in 1932 he received an Sc. D. in geology from Harvard University. Before joining Schlumberger in 1936, he did research work for General Motors Corporation.

Welex Jet Offers Perforating Services in South Texas Area

The jet method of oil well perforating has been made available to operators in the Houston and South Texas area by Welex Jet Services, Inc., which has opened a Houston station at 6512 Del Rio Street.

Cecil Puryear will manage the new station. He was formerly station manager of the Welex branch at Wichita Falls, and before that worked with Lane-Wells Company and McCulloch Tool Company. Sales manager of the Houston station will be Kenneth Daggett, who transferred from the Welex office in Fort Worth.

The Houston branch is Welex's fourth. Others are in Odessa and Wichita Falls, Texas and Ardmore, Okla., with home offices in Fort Worth. Research and further development of the shaped Jet charge for use in oil well perforating is being conducted from the Fort Worth office under the supervision of Henry H. Mohaupt.

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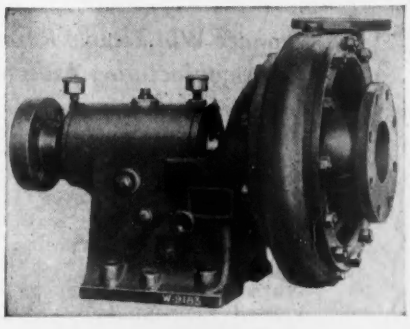

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This versatile all-steel rig drills top-to-bottom wells to 2500-3000 feet, tails in after rotaries, cleans out and plugs wells to 3000-4000 feet. Its two speeds forward and one-speed reverse on all reels, together with plenty of power, defy the toughest jobs. Star's exclusive balanced design and rugged construction mean dependable, economical service and long life. Many operating advantages combine with ease of moving and quick rig-up to give low cost performance and increased profits.

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SOME No. 83 FEATURES:

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2. Double brakes on all reels.
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4. Fast, powerful, full-width sand reel for efficient bailing.
5. Powerful casing reel, free-running, with built-in friction clutch.
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7. Dependable V-belt drive.
8. Double-crank drive spudder balances drilling load.
9. 60' telescoping mast.
10. 44 anti-friction bearings.

MOUNTINGS: full-trailer, semi-trailer or skid.

Now you can get this and other Speed Stars at greatly *Reduced Prices!*

"If it's a Speed Star, it's a Fast, Proven Money-Maker"

THE STAR DRILLING MACHINE COMPANY

475 WASHINGTON STREET • AKRON 11, OHIO

Drilling Machines and Tools Since 1889

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Frank Champion Elected to Head Spartan Tool and Service Company

Frank Champion, Houston, has been elected president and general manager of the Spartan Tool and Service Company. Spartan, which operates in the Texas Gulf Coast, Southwest Texas, West Texas, California, Louisiana and Rocky Mountain regions, does oil well cementing, gun perforating and testing, squeeze jobs, jet perforating in connection with test tools, wire line perforating and open hole formation testing. Other services include acid tools and bulk cement.

Frank Champion

At the time he was named to head the Spartan company, Champion resigned as president and general manager of Wright Drilling Company, Inc. A graduate engineer of the University of California, Champion was formerly vice president and general manager of the Oil Tool division of Byron Jackson Company. He is a member of the Los Angeles and Houston chapters of Nomads.

McCullough Tool Company Names Sales Engineer at Casper Branch

McCullough Tool Company, Los Angeles, has appointed John B. McElheny sales engineer, operating out of the Casper, Wyo., branch. McElheny was for the past nine years manager of operations for International Cementers in the Rocky Mountain area.

John B. McElheny

The McCullough Casper office is under the direction of Dick Mays.

Standco Will Rebuild Razed Plant For Manufacturing Asbestos Yarn

Plans for a new building have been made and machinery has been ordered to replace that lost in a fire April 12 at the Standco Brake Lining Company, 2701-2801 Clinton Drive, Houston.

The blaze, which was started by a welding torch, was confined to a $30,000 building which housed the Asbestos Yarn Manufacturing department and caused approximately $200,000 damage to machinery.

According to C. W. Hanslip, Standco president, the firm secured yarn from outside sources and production was immediately returned to normal.

The new building will be air conditioned for efficient production of asbestos yarn to be made into Standco brake lining and brake blocks.

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★ PRACTICAL OIL LOAN EXPERIENCE

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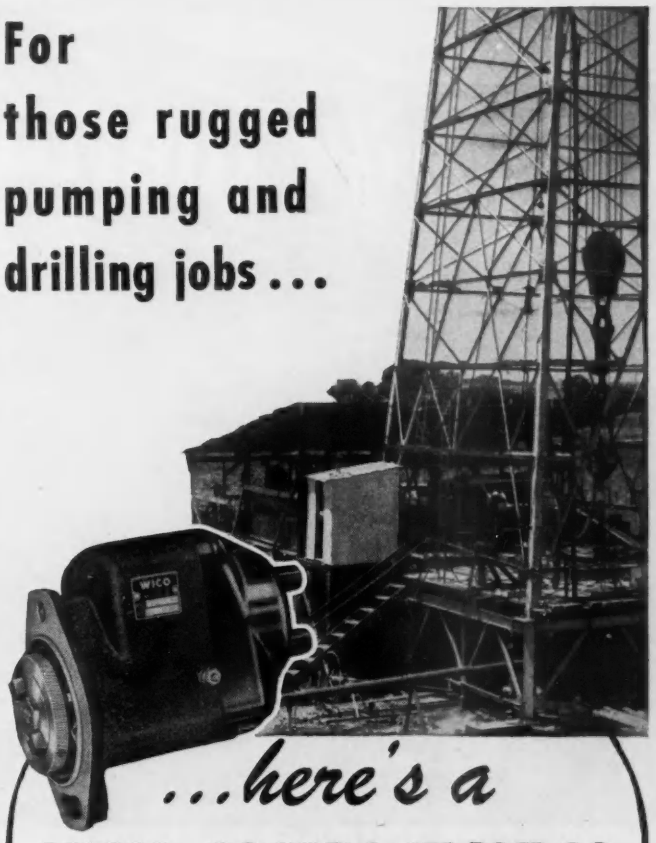
WARM, FRIENDLY BANKING AND TRUST GUIDANCE

For those rugged pumping and drilling jobs...



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NEW, COMPACT WICO heavy duty magneto

No matter how many hours of continuous service you need . . . no matter how much dust or dampness . . . your engine will get the regular, hot spark it needs from this WICO Model XHD magneto. It's a *new* magneto, designed to do the hard work you need done. It's compact. The molded insulated coil is stronger so there's less chance of breakdown. This solid plastic case is far tougher than a tape winding. A specially made bronze bushing and ball bearing, lubricated for life, insure trouble-free service. The large — 3/16" — tungsten contacts resist fouling, wear longer. Built-in impulse coupling. On flange-mounted models, a Buna-N oil seal prevents leakage. Available for 4 or 6 cylinder engines, flange or base mounted.

This *new* WICO Model XHD is the finest magneto available for engines operating in continuous service under the most adverse conditions that require ignition units of exceptional stamina and ruggedness.

If you've had ignition trouble, chances are this economical WICO XHD will change that. Ask your equipment dealer, or one of WICO's more than 2,000 authorized service stations. Wico Electric Company, West Springfield, Mass.

SINCE 1897
WICO
DEPENDABLE IGNITION

Thermoid Impregnation Process Assures Longer V-Belt Life

Men who are responsible for the operation of oil field equipment know that Thermoid V-Belts are really built to withstand the roughest oil field service. They know, too, that Thermoid engineering and first hand knowledge of oil field needs mean longer V-Belt life and lowest operating costs.

It will pay you to *Specify* Thermoid!

The Thermoid Impregnation Process insures a deeper penetration of rubber between the threads of the yarn, which encases each individual strand with protective rubber. The rubber acts as a sheath between the strands and prevents the destructive abrasion action as the product is flexed in use. To obtain the required rubber penetration, the twist of the yarn must be to exact specifications. With the yarn twisted too tightly, proper penetration of the rubber compound is impossible. This condition produces abrasion, causing premature failure. On the other hand, if the yarn is twisted too loosely, the product lacks tensile strength. Thermoid has discovered the optimum twist of the yarn which assures maximum rubber penetration and greatest strength. The development of Thermoid Impregnation Process is another step forward in Thermoid's planned program of product improvement, assuring maximum service and lower operating costs to industry through the use of Thermoid Industrial Rubber Products.

Thermoid Quality Products: Oil Country Flat Belting • Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All types of Hose • Molded Specialties • Powerflex Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • Brake Blocks • F.H.P. and Multiple V-Belts.

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Industrial Rubber Products • Friction Materials • Oil Field Products

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Claude L. Griffin

Elmer E. Rubac

American Iron & Machine Works Promotes Two at Oklahoma City

The American Iron & Machine Works Company announced the appointments of Claude L. Griffin as assistant sales manager, and Elmer E. Rubac as assistant to M. G. McCool, general manager.

Griffin has been with the company two years and was formerly sales engineer. He started in the oil industry as a roughneck in 1931 and subsequently was an organizer and shop foreman of the Jeddy D. Nixon Company. During the war, he was consulting engineer for reduction gearing for the U. S. Navy for two years. He was Mid-Continent engineer for Reed Roller Bit Company for five years. Griffin studied mechanical engineering at the University of Houston and petroleum engineering at the Colorado School of Mines. He obtained his degree in mechanical engineering in 1939 from the Colorado State College of Mechanical Arts.

Griffin will coordinate sales activities in all territories and will make his headquarters in Oklahoma City.

Rubac will be in charge of advertising, Oklahoma City sales office, warehouse and shipping department, as well as coordinator between all departments at the main plant in Oklahoma City.

Rubac has been with the company since 1937 with the exception of three years in the service. Prior to entering the service, he served in various departments of the Oklahoma City and Houston offices. Since his return he has worked in the advertising and sales departments in the Oklahoma City office.

Champion and Smith Will Export Rector Well Equipment Products

Rector Well Equipment Co., Inc., Fort Worth, has appointed Champion and Smith, Inc., as its exclusive export representatives in all territory outside the U. S. and Canada for Rectorhead tubing and casing heads; cementing equipment; Rectorseal and other Rector equipment. Champion and Smith, Inc., has offices in Houston, New York and Los Angeles.

Kerbo Transfers to Odessa

George Kerbo has been transferred from Casper, Wyo., to the Odessa, Texas, office of Patterson-Ballagh, division of Byron Jackson Company. He will be sales representative at Odessa, and will handle the newly designed Patterson-Ballagh casing and drill pipe protector.

BOWEN AUTOMATIC LINE WIPER No. 8000

Bore of Body	2¾"
Connection	3"
For Line sizes	3/16 to ⅞"

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SWABBING - BAILING
WIRE LINE CORING

*Wipes the line clean
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Chief Geologist of the Sun Oil Company,
Formerly Assistant Professor of Geology,
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Revised and up-to-date Fourth Edition

A standard and widely-used manual of geological exploration and mapping, combining both textbook and reference features, especially suitable for petroleum and mining geologists and engineers. Presents methods and keys for the recognition and interpretation of land forms and structures, and explains fully how to take and record data in the field, make and interpret maps, etc. Fully revised in line with advances in geological research and practice, with valuable new material on mass movement, flow structures and fracture systems in igneous rocks, directional drilling, use of gamma-rays in subsurface correlation, and electrical logging.

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Ideal also for fishing small objects—widely used for drilling in (completing) wells, and for drilling cement or plastic plug overages.
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Arkansas:
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Texas:
HENDERSON, J. C. Philippi, Mgr. East Texas Div., Phone 9716-J1
SERVICE, B. & H. Pump Co., Turnertown
HOUSTON, W. A. Swink, Phone Wydown 9-2858
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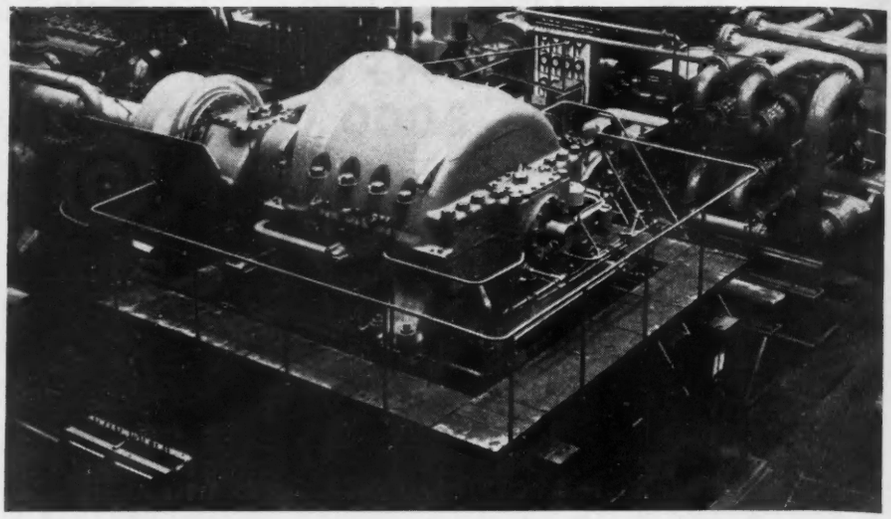


TEST COMPRESSORS—Complete facilities for testing centrifugal compressors and expanders are located at the Clark Bros. Company, Inc., plant at Olean, N. Y.

Clark Bros. Manufactures Largest Compressors for Hydrocol Plant

Totaling more than 80,000 horsepower, 24 centrifugal compressors have been designed and built by Clark Bros. Company, Inc., Olean, N. Y., for installation in the Carthage Hydrocol, Inc., process plant at Brownsville, Texas.

A single air compressor unit in one minute compresses the volume of air that would be enclosed in a pipe 12 inches in diameter and 27 miles long, according to Clark Bros. One of the compressors will be driven by an air-expansion type turbine. The two main air compressors will compress 111,000 cubic feet per minute to 108 pounds per square inch, and have a power requirement of 23,000 horsepower each. The steam turbines require 125 tons per hour of steam.

Among the safety precautions incorporated in the design of the oxygen compressor is prevention of contact of the oxygen and oil. Internal parts of the compressor are made of special bronze alloy and water-cooled to maintain safe internal temperature.

English Firm Will Make OCT Products

In order to make American-designed oil well pressure control equipment immediately available in unlimited quantities to oil-producing areas which operate on a pound-sterling basis, Oil Center Tool Company has licensed LeGrand, Sutcliff & Gell, Ltd., for the manufacture of OCT products in England, John Maher, president of Oil Center Tool Company, Houston, announced.

The pound-sterling is the basis of exchange used throughout the British Empire, which includes some of the world's richest petroleum deposits, and for the purchase of material in other countries where British-owned companies operate.

"Oil Center Tool Company has made available to the LeGrand organization all technical help and advice to insure that LeGrand-OCT products fully meet all material specifications and the rigid inspection requirements for which OCT products are known in the U. S. and throughout the world," Maher stated.

Maher entered into initial negotiations with the British firm during a trip to England and Holland early in 1948. J. E. Eckel, vice president in charge of engineering, visited the two countries late in 1948, and, in cooperation with the LeGrand staff, contacted the oil companies purchasing on the pound-sterling basis. A large quantity of required material was determined and placed on order by the oil companies. Eckel then assisted the LeGrand staff in determining the required raw material. In January, 1949, Fritz Richard, OCT vice president in charge of manufacturing, Walter Stovall, technical adviser on tooling, and R. K. LeRouax, development engineer, went to LeGrand's Rochester plant to assistant LeGrand personnel in placing the material into production.

Southern Engine & Pump Company Opens Branch Office at Houma

Southern Engine & Pump Company, Houston, has opened a branch at 1138 Barrow Street, Houma, La. The branch office will be in charge of W. G. Byl, who has been in charge of service operations in South Louisiana.

THOMPSON-HAYWARD
FORMALDEHYDE
for corrosion control

You can protect your casings, rods, and all exposed metal parts for only a few cents a day. You can

- SAVE ON PULLING COSTS
- SAVE ON NEW STEEL
- SAVE ON SHUTDOWN TIME

Thompson-Hayward Formaldehyde gives dependable protection from hydrogen sulphide corrosion and corrosive mine and well waters.

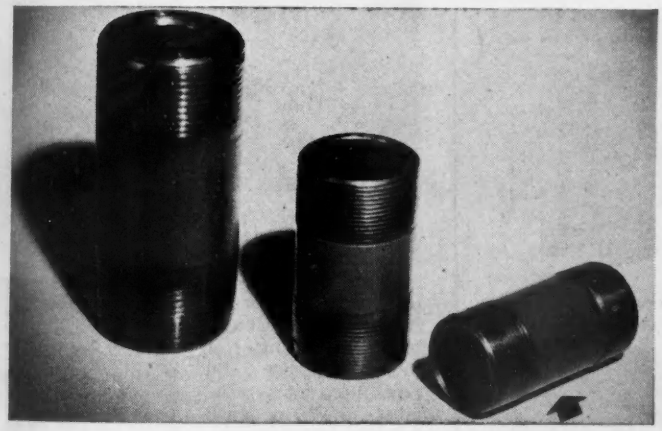
Write our nearest office for detailed information

THOMPSON-HAYWARD CHEMICAL CO.

Dallas, Houston, Denver, Wichita, Tulsa, San Antonio, New Orleans

(B)

LONGHORN QUALITY
SINGLE X and DOUBLE X LATHE CUT
SEAMLESS NIPPLES



Manufactured from new seamless tubing, precision machined for bevel and taper, threaded and accurately gauged.
Threads are positively protected from rust, corrosion and damage by a plastic coating, which is easily peeled off when ready to use.
Sizes ¼" through 6⅝" in standard lengths. Special sizes, brass, stainless and monel furnished to requirements.

SOLD ONLY THROUGH SUPPLY STORES
Write for literature and price lists

Longhorn MACHINE WORKS
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RLA TOP LOCK

FOR MORE SERVICE IN YOUR WELL
LESS SERVICING AT THE SURFACE
Specify Pacific Precision Built
OIL WELL PLUNGER PUMPS

REQUIRE LESS SERVICING AT THE SURFACE BECAUSE OF MAXIMUM PROTECTION FOR THE CRITICAL ZONE

By Selecting Materials For
PLUNGERS · LINERS
VALVES · VALVE SEATS
VALVE CAGES

To resist corrosion and finished with the hardness necessary
TO RESIST ABRASION AND WEAR

PACIFIC OIL STATES SECTIONAL LINER PUMP

TRAVELING BARREL TYPE
TRAVELING PLUNGER TYPE

BUILT TO API STANDARDS WITH PACIFIC PRECISION FINISH

PACIFIC
Precision Built
PUMPS

PACIFIC PUMPS INC.
One of the Dresser Industries
HUNTINGTON PARK, CALIF.

MID CONTINENT DIVISION—[illegible]
EXPORT OFFICE—[illegible]

HOLD DOWN

DW-1

SALES AND PLANS MEETING—Directors, sales representatives and key employes of the Bettis Corporation, Houston, are shown at the company's annual Sales and Plans meeting, held to outline and discuss the sales program and aims of the company for each year. Highlight of the meeting was the presentation of a new automobile to Mrs. D. L. George (left, seated), secretary and treasurer, in commemoration of her 20 years service with the company. The presentation was made by John M. Sheesley, left, vice president and sales manager.

Gas Turbines Contract Is Let For Tennessee Gas Pipe Line

One of the first experimental gas turbines specifically designed for installation in gas pipe line service will be built for Tennessee Gas Transmission Company jointly by Clark Bros. Company, Inc., Olean, N. Y., one of the Dresser Industries, and Frederic Flader, Inc., North Tonawanda, N. Y.

With an expected thermal efficiency of more than 30 percent, the new turbine, a gas-fired unit, will develop 5500 horsepower to drive a centrifugal compressor to be installed in the Tennessee company's gas line near Moorehead in eastern Kentucky.

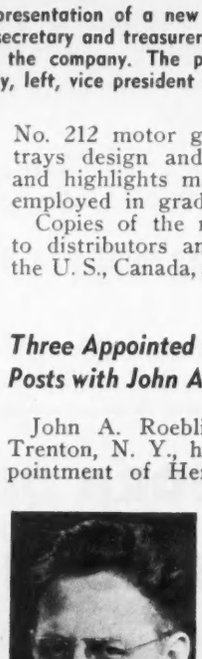
Movie on Motor Graders Released By Caterpillar Tractor Company

Caterpillar Tractor Company, Peoria, Ill., has announced production and distribution of "Better Blading," a 20-minute color motion picture treating of the manufacture and work capabilities of Caterpillar diesel No. 12, No. 112 and No. 212 motor graders. The film portrays design and engineering features and highlights materials and processes employed in grader production.

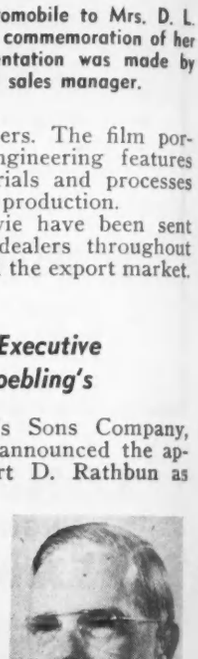
Copies of the movie have been sent to distributors and dealers throughout the U. S., Canada, and the export market.

Three Appointed to Executive Posts with John A. Roebling's

John A. Roebling's Sons Company, Trenton, N. Y., has announced the appointment of Herbert D. Rathbun as secretary and treasurer. He succeeds Archibald W. Brown, who retired after 47 years service but continues as a director of the firm. Rathbun, a graduate of Hamilton and Pace colleges, has been associated with Roebling since 1938.



Clarence W. Snyder



Herbert D. Rathbun

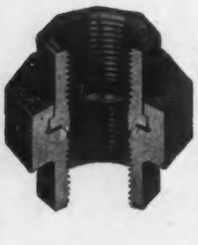
H. Russell Brown

Clarence W. Snyder has been made comptroller and assistant secretary, and H. Russell Brown has been named assistant secretary and assistant treasurer. Snyder is a graduate of Ohio State University and has been with Roebling since 1940. Brown has been with the company since 1935 and has been serving as general accountant and assistant secretary. He was graduated from John B. Stetson University.

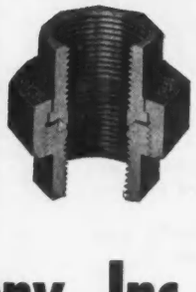
Jefferson Malleable Unions

STYLE "B"—3-Part Ground Joint pipe line flange union greatly facilitates the laying of pipe and especially where pipe is out of alignment. Certified Air Furnace iron. Sizes ½" thru 10".

STYLE "A"—Ground Joint union and union fittings. Complete line straight and reducing. Sizes ⅛" thru 2½"—3000 lb. test; 3" and 4"—2000 lb. test. Made of Certified Air Furnace iron.



ENDURO—300 lb. S.W.P.—600 lb. C.W.P. unions. Sizes ⅛" thru 3".



EXCEL—250 lb. S.W.P.—500 lb. C.W.P. unions. Also a complete line of unions, ells and union tees with union on the run. Made of Certified Air Furnace iron. Sizes ¼" thru 3".

Obtainable through your jobber

Jefferson Union Company, Inc.

691 West 26th St., New York 1, New York

71 Gooding St., Lockport, New York

31 Fletcher Ave., Lexington 73, Mass.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Oil Well Supply Appoints Hays, Names Five in Eastern Division

George A. Hays, Jr., Tulsa, has been named director of market development of Oil Well Supply Company, U. S. Steel subsidiary. His headquarters will be at Tulsa.

George A. Hays

Hays was connected with Wilson-Snyder Manufacturing Division and its parent company, Oil Well Supply, for 24 years prior to October, 1946, when he resigned to become associated with Hinderliter Tool Company at Tulsa.

In his new position at "Oilwell," Hays will assist all divisions in promoting new products and markets.

In the Eastern division, Seymour L. Brown, manager of the Mt. Pleasant, Mich., branch store since 1944, has been named district material supervisor of the Michigan district, with headquarters at Mt. Pleasant. He is succeeded by William F. Corbin.

Carl R. Nelson has become assistant district material supervisor of the Pennsylvania district and will headquarter at Bradford, Penn.

Brown joined "Oilwell" in June, 1937, and was connected with the Mt. Pleasant and Muskegon, Mich., stores until May, 1943, when he was named manager of the Grandville, Mich., store. Corbin, except for three years Army service, has served in the Mt. Pleasant store since being employed by Oilwell in 1941. Nelson joined the company at its Bradford store in 1941. Since 1946 he has been connected with the store at Washington, Penn.

E. E. Branson, warehouse supervisor at Columbus, O., has been transferred to Charleston, W. Va., as assistant district material supervisor of the Ohio-West Virginia district of the Eastern division. Branson is succeeded by F. B. Lane, who has been with "Oilwell" more than 28 years.

Branson joined the company in June, 1944, and served in Illinois stores at Salem, Mt. Carmel, Mattoon and Fairfield. In September, 1947, he was named manager of the Carmi, Ill., store. He has been warehouse supervisor at Columbus since February, 1948.

Lane spent eight years at the Imperial Works plant at Oil City, Penn., and from 1930 to 1947 he was with the Eastern division office, first at Oil City and later at Columbus. Since June, 1947, he has been with the Newark, and Wooster, Ohio, stores.

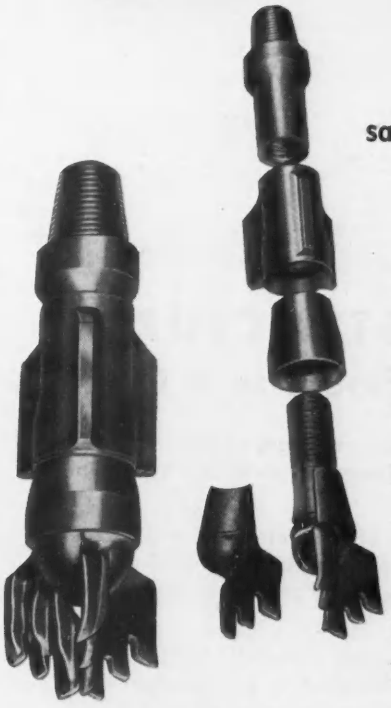
Schlumberger Engineer Transfers

J. C. Bellicard, chief engineer for the Houston Electrical Production department of Schlumberger Well Surveying Corporation, has been transferred to Mexico where he will take charge of the Schlumberger Surenco Mexico City office. Bellicard will be technical adviser to Pemex.

EXPLORATION DRILLERS:

HAWTHORNE *Replaceable Blade* "ROCK CUTTER" BITS

cut bit and footage costs... drill faster!



You owe it to yourself to find out about the important savings obtainable with Hawthorne 'Rock Cutter' Bits.

● If you are now using drag bits and roller bits, you'll find that Hawthorne Bits will do the job faster, at less cost. In fact, you can probably double your drilling efficiency and cut cost-per-foot in half with Hawthorne Bits.

Dollar for dollar and pound for pound, Hawthorne Replaceable Blade 'Rock Cutter' Bits are by far your best buy!

(Patents Pending)

All Formation Drilling

Hawthorne Rock Cutter Bits have proved capable of drilling more hole in soft formations in less time than any conventional drag bits. Moreover, these blades efficiently drill broken formations and 75% of all rock formations normally requiring roller bits.

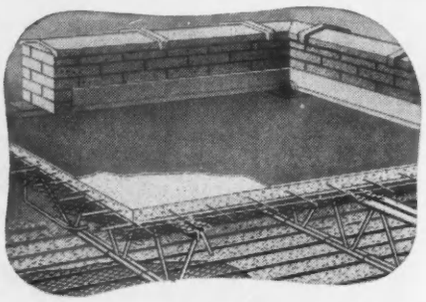
"On the Drill" Bit Service

There is no "bit service" problem when you use Hawthorne Replaceable Blade Bits. Twelve sets of blades weighing only 2 to 3 pounds per set, come in plainly-marked boxes that are easily carried with the drill . . . easily and quickly installed.

See GEOPHYSICAL DIRECTORY or COMPOSITE CATALOG for lists, parts, prices—or write for illustrated Catalog. Hawthorne Bits are available in a range of sizes to fit any drill.

HERB J. HAWTHORNE INC.

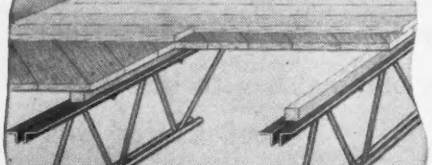
P. O. BOX 7299 HOUSTON 8, TEXAS

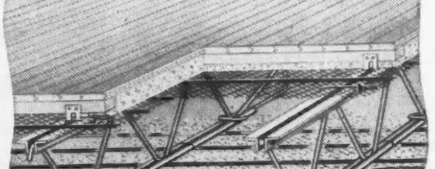


SHEFFIELD

OPEN WEB

STEEL JOISTS





THE MODERN STRUCTURAL

For Supporting Roofs, Floors and Ceilings

The architect's renditions above show you how readily Sheffield Steel Joists are adaptable to the application of most any type roof, floor or ceiling.

When used to carry various designs of concrete slab and plaster ceilings, they have as much as a 4 hour fire rating and eliminate the dangers of twisting, sagging, shrinkage, decay and attack by termites and rodents.

Light in weight, Sheffield Joists are easier to install. No false-work or shoring is required. They enable designers to effect other economies throughout an entire structure. A wide selection of span lengths up to 40′ clear span and joists types, from 8″ to 20″ depths, simplify design problems.

Write today for brochures giving latest details and showing how widespread Sheffield Steel Joists are used in all types of buildings.

SHEFFIELD STEEL CORPORATION

HOUSTON KANSAS CITY TULSA

SALES OFFICES: Chicago, Ill.; St. Louis, Mo.; Des Moines, Ia.; Omaha, Nebr.; Wichita. Kans.; Denver, Colo.; Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; Lubbock, Tex.; New Orleans, La.; Shreveport, La.

SHEFFIELD STEEL

Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard, Reinforcing Bars

Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Schmidt Transferred to Tulsa To Head Reed Roller Bit Office

R. C. Schmidt, Reed Roller Bit Company, has been transferred from the West Texas division at Midland to head the company's sales office at Tulsa. He succeeds C. A. Nabors, resigned, who is now with Parker Drilling Company.

Prior to joining Reed, Schmidt was a field engineer for Technical Oil Tool Corporation, Ltd., Los Angeles. He was an officer in the Navy during World War II.

R. C. Schmidt

Baroid Sales Division Makes Three Executive Appointments

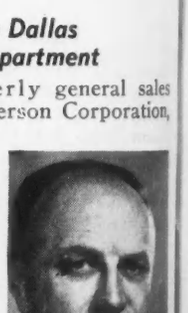
W. L. Heater has been named general sales manager of the Baroid Sales division of National Lead Company. Heater joined Baroid in 1934, and was Pacific Coast division manager until 1946, when he was appointed assistant to the general manager, a title he retains.

Edward J. Hagstette, Jr., formerly an assistant to Heater, has been appointed manager of the products procurement department, in charge of the purchase of raw and finished materials for resale. He began with Baroid as a field engineer in the Gulf Coast division. In September, 1947, he was transferred to Los Angeles as assistant to Heater.

Arthur Langton, new manager of the Advertising department, began in 1935 as a technical editor with the Baroid Sales division, and has been associated with the Advertising department ever since.

Pranger Joins Ideco's Dallas Technical Service Department

Al Pranger, formerly general sales manager for the Guiberson Corporation, has joined International Derrick and Equipment Company's Technical Service department, and will make his headquarters with the Ideco Machinery and Export Sales offices in Dallas.



Al Pranger

Pranger received his engineering education in Amsterdam, Holland, and came to the U. S. after graduation. Prior to his association with Guiberson, Pranger served as an engineer with the Oil Well Supply Company and was chief engineer of Ideco's Beaumont, Texas, plant from 1929 to 1933. He is a member of the API, Dallas Petroleum Engineers' Club and S.A.M., and a charter member of the Dallas Chapter of Nomads. During World War II, he served as a lieutenant colonel in the Army Chemical Corps.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Davis D. Bovaird Is Elected Tulsa Supply Firm President

Davis D. Bovaird, for many years vice president and treasurer of the Bovaird Supply Company was elected president of the firm succeeding his brother, W. M. Bovaird, who died recently. He joined the firm at Independence, Kansas, after graduating from the University of Michigan in 1920 and in 1923 became manager of the company's manufacturing plant. He moved to Tulsa headquarters as credit manager in 1927.

He is a director of the Public Service Company; director and past president of the Tulsa Community Chest; director of the Rotary Club; elder of the First Presbyterian church; trustee of the College of Emporia, Emporia, Kansas; former board member of the Tulsa Boys Home, YMCA and Council of Social Agencies and is a trustee of Southwestern Art Association.

The new president, together with F. D. Bovaird, vice president; Roscoe G. Ayers, vice president and general manager of sales; R. M. McMahan, secretary-treasurer, and A. E. Both, Bradford, Penn., comprise the new board of directors of The Bovaird Supply Company. M. B. Park, former assistant secretary, is now assistant secretary-treasurer.

Sales Engineers Are Appointed For Orchem Reciprocating Pumps

Orchem Pump division of Orlick Bros. Machine Works, Philadelphia, has appointed Stentz Equipment Company district sales engineers in Kansas, Oklahoma and Texas, for its line of positive displacement reciprocating pumps.

S. L. Stentz

Stentz Equipment Company was organized early in 1946 as a specialty engineering sales organization. S. L. (Sturge) Stentz, the founder, after graduation from Carnegie Institute of Technology, spent 12 years in engineering sales work in the Midwest prior to entering military service with the Air Force.

Sales offices of the company are in Dallas, Houston and Wichita, in addition to headquarters at Tulsa. Products represented are primarily pumps and heat exchangers, in addition to SECO automatic shut-off equipment. The line of Orchem pumps expands its liquid transfer equipment to handle flows from one pint to 3000 gallons per hour at pressures up to 25,000 pounds per square inch.

Purchasing Agent Appointed

Eric L. MacEwan has been promoted to purchasing agent for Norvell-Wilder Supply Company at Beaumont, Texas. MacEwan attended Hobart College at Geneva, N. Y., and served in the U. S. Air Corps during World War II. He has been with Norvell-Wilder for five years.

The deeper you go the greater the need for Slush Pump parts that will handle greater pressures and last longer. Old methods of producing Piston Rods are inadequate. Harder rod surfaces and tougher cores are necessary.

Falcon, with Inductioning Hardening methods, uses a greater tensile alloy steel than ever before. This makes for greater resistance to bending stresses and for stronger rod threads.

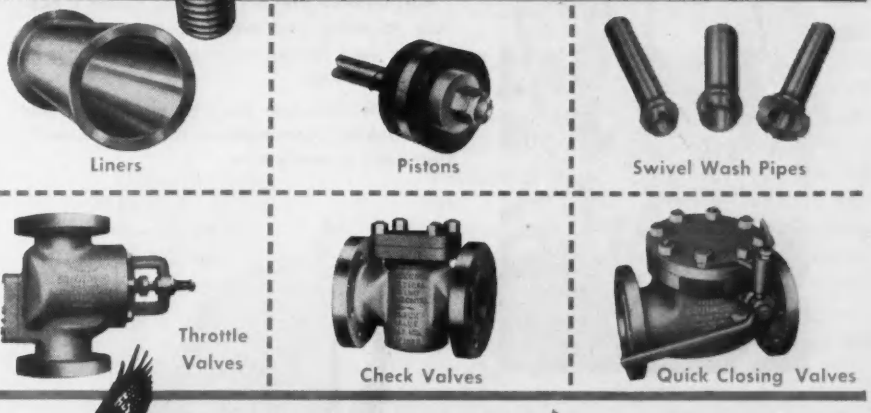
Sold through leading supply stores everywhere

Induction Hardening also means a uniform hardness the full length of rod. Heavy grinding into hardened surface to obtain straightness is unnecessary, therefore no "spotty" areas subject to rapid wear.

Induction Hardening is the answer. Order Falcon Induction Hardened Rods.

Send for Falcon Bulletin No. 106

OTHER FALCON PRODUCTS



FALCON PRODUCTS LAST LONGER

FALCON PRODUCTS, INC.
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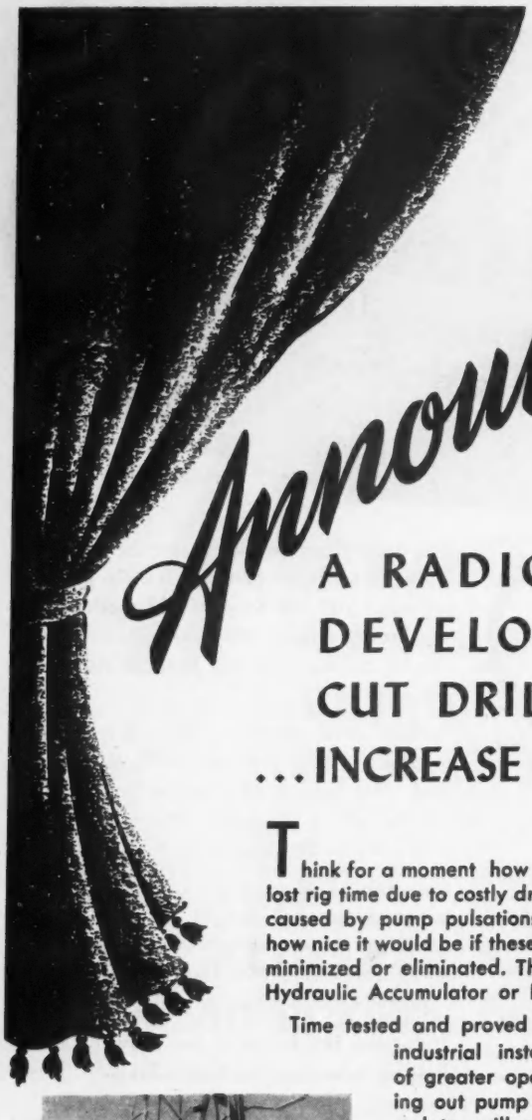
BRANCH WAREHOUSES: HOUSTON, ODESSA, WICHITA FALLS, TEXAS • CASPER, WYO.
OKLAHOMA CITY, OKLA. • SHREVEPORT, LA. • BAKERSFIELD, LONG BEACH, CALIF.
Export Representative: Guy E. Daniels, 30 Rockefeller Plaza, New York 20, N. Y.



Announcing!

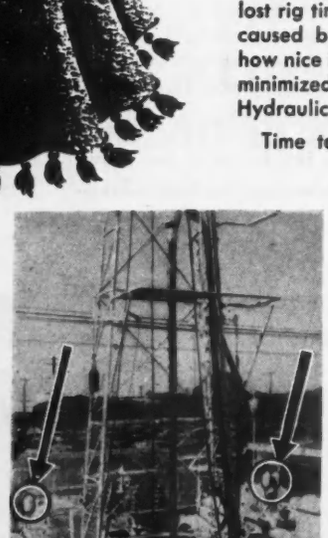
A RADICALLY NEW DEVELOPMENT TO CUT DRILLING COSTS ...INCREASE PRODUCTION

Think for a moment how much it's costing you daily for lost rig time due to costly drilling rig and pipe line failures caused by pump pulsations and line shocks. Now think how nice it would be if these costly stoppages were greatly minimized or eliminated. They can be, too, with a Greer Hydraulic Accumulator or Pulsation Dampener.

Time tested and proved performance in thousands of industrial installations are your guarantee of greater operating economy. By dampening out pump and line pulsations the accumulator will provide smoother flow and reduce costly repairs to pumps, engines, valves, gears, pipe lines, suction and rotary hoses and other components.

Furthermore, the accumulator makes it possible to compound power pumps and may also be used for starting the Diesel Engines in your Power Rigs.

Get the complete story by writing for our free booklet "Accumulators for Fluid Power". Your copy is ready now.



Oil Drilling Rig

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

YOUR SYMBOL OF SERVICE

GREER

HYDRAULICS INC.

454 EIGHTEENTH ST., BROOKLYN 15, N. Y.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Warner F. Parker

Donald S. Grubbs

Oil Well Supply Announces Appointments in Two Divisions

Donald S. Grubbs has been named manager of the California division of Oil Well Supply Company. Warner F. Parker, assumes the new position of sales manager in the division.

Grubbs received his degree in business administration from the University of Pittsburgh. He joined "Oilwell" in the Accounting department at Pittsburgh in 1929, and advanced successively through positions of chief clerk of the Accounting department, assistant auditor and auditor, and in November, 1944, was named comptroller. He moved to Dallas in 1932 when "Oilwell's" general offices were transferred to that city. In June, 1941, Grubbs returned to Pittsburgh as audit supervisor for the U. S. Steel Corporation of Delaware. He left the corporation in December, 1945, and at the time of this appointment was secretary and treasurer for Adel Precision Products Company at Burbank, Calif.

Parker has been with "Oilwell" 27 years, including nearing 20 years in various sales positions in the California division. He majored in economics at Stanford University, where he was graduated in 1921.

Oil Well Supply Company has promoted W. A. Weir, district manager of the Canadian district, to assistant Rocky Mountain division manager, in charge of "Oilwell's" activities in Canada. His headquarters will be at Calgary, Alberta, where he has been located since he became Canadian district manager in July, 1945.

Weir attended the University of Colorado and joined "Oilwell" in April, 1929. He was connected with several branch stores in the Rocky Mountain division, and in March, 1942, was transferred to the material department at Dallas, where he served until his transfer to Canada.

Seismograph Service Corporation Elects Officers and Directors

G. H. Westby was elected president of Seismograph Service Corporation, Tulsa. Other officers are A. J. Barthelmes and J. E. Hawkins, vice presidents; A. B. Chappell, vice president and treasurer; John S. Charlson, secretary and general counsel, and J. L. Hull, Jr., assistant secretary.

T. A. Manhart has resigned as executive vice president but will remain as a director.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

J. J. Sieber

Fred Zimmerman

Broderick & Bascom Announces Sales Staff Executive Changes

Broderick & Bascom Rope Company, St. Louis, has named Fred Zimmerman, vice president who has been in charge of sales, to the new title of director of sales, J. J. Sieber has been appointed sales manager.

Zimmerman joined the Brokerick & Bascom organization in 1911, and has been with the firm continuously since then. Sieber was formerly chief product engineer, and was previously with the Seattle factory and branch as sales engineer. He joined the company in 1929.

Quillen Joins Nordstrom Valve Sales Staff in New York City

Nordstrom Valve division, Rockwell Manufacturing Company, has added C. S. Quillen to the sales engineering staff in the metropolitan area of New York City. M. J. Harper is manager of the district.

C. S. Quillen

Quillen was graduated from Drexel Institute of Technology as a chemical engineer in 1933. He has sold process plant equipment in the metropolitan area for the past ten years.

Yugoslavs Award Continental Contract for Oil Equipment

Continental Supply Company has been awarded contract for furnishing "several million dollars' worth" of oil drilling equipment and tubes to the Yugoslav Ministry of Mines. The contract is one of the largest between the Yugoslavs and a U. S. firm since Marshal Tito's break with the Cominform.

American technicians will go to Yugoslavia to supervise the installation and operation of the equipment.

Geolograph Opens Casper Office

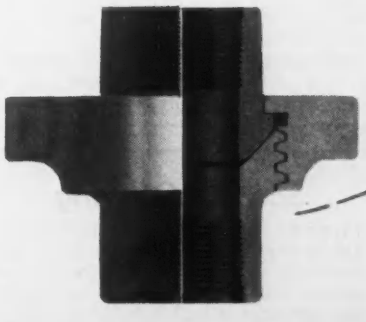
The Geolograph Company, Inc., has opened a district office at 1136 North Glenarm, Casper, Wyo., to serve Wyoming, Montana, Colorado, Utah and North Dakota. Harry F. Miller has been transferred from the Oklahoma City general office to Casper. Other district offices are at Shreveport and Alice, Texas.

First, last and always a working dog, the German Shepherd is distinguished for dependability, and courage, and the ability to adapt himself to numerous services. Poised and unexcitable, he imparts a feeling of confidence to those whom he serves, whether he's guarding sheep, doing police work or serving as an eye for the blind.

Ordinarily, he's not an ill-tempered brawler, but woe be it to the man or animal who interferes with the discharge of his duties. When need be, he is a fearless fighter, with courage and physique equal to 'most any task his sense of duty prompts him to undertake.

Natural courage and intelligence, coupled with years of careful development, well conditioned the Shepherd for his most spectacular duty. When the need arose for war dogs, he received first call. Thousands of G.I.'s with whom he served relied upon him for protection and assistance. It was a well-placed reliance . . . even in this most extra-ordinary service, the German Shepherd kept untarnished his reputation for loyalty and dependability.

Through many years' service under varied conditions, WECO Unions likewise have established an outstanding record for dependability. They, too, have been carefully developed and proved for many duties. Wherever they are used, they stand as symbols of security . . . finest protection available anywhere. They're sold through all leading supply stores.



WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. New York 7
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. New York 7

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Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

WORLD OIL'S Trading Post

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RATES: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. **All classified ads payable in advance.** 10% Discount if 3 or more insertions are ordered at one time. **COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

FOR SALE

FOR SALE

1—Model K. Cardwell Double Drum Drawworks with rotary table drive and transmission assembly, American cathead.
2—D13,000 Caterpillar engines.
1—Type FE 12½" National Rotary Table.
1—3½" Kelly.
2—3½" Drill Collars.
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Cherryvale, Kansas

SPECIAL OFFERING

DIESEL GENERATORS

Three **new, 60 KW Generators,** 300V D.C., 200 Amps. powered by GMC Model 6-71 Diesel, with 2 KW Exciters. Original crates complete with spare parts. $3950 each.

ALSO

Two 20 KW D.C., 115V Generators. Powered by GMC series 2-71 Diesels completely rebuilt. Both including switchboard. $2900.

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It's New... Check It!

PIPE GRINDING MACHINE designed and built to give pipe line contractors maximum service in polishing the bevel on plain end pipe in preparation for welding. The machine can be placed on pipe easily and quickly, and will clean the bevel on 24-inch pipe in 15 seconds, whereas a man with file would have to work at least 15 minutes. The grinder is constructed for durability, light weight, effectiveness and economy. Electrically driven, it may be operated from electric welding machines on the line.

The Machine was perfected, and now being manufactured by

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Under license from O. R. Hall, inventor

FOR SALE

■ WELL drilling spudders, beams, light rotaries, core drills, tools and casing. Used equipment at money saving prices. Spang and Mills new tools. Leschen lines. Everything for well drilling. Pressey & Son, Pueblo, Colo.

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ELECTRIC PUMPS

Five Deming Oil Cargo Pumps 650 GPM, 150' head, 25 HP, 220/440V, A.C., U. S. Elect. Mtrs. Used. $390 each.

ALSO

Two Deming Cargo Stripping Pumps 150 GPM, 2 HP, 220/440V, A. C., U. S. Elect. Mtrs. Used. $150 each.

ALSO

Five **New Viking Pumps** (Rotary type) 100 GPM with 5 HP, 1750 RPM, 220V motor, A.C. Complete set spares. $300 each.

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FOR SALE

ONE No. 10 UNIT RIG DRAWWORKS with Two D13000 Caterpillar Diesel Engines Compounded. Equipment in good shape. KIOWA DRILLING COMPANY, INC., 717 Union National Bank Building, Wichita 2, Kansas. Phone 3-8013.

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MARINE MOTORS

Four **new, Hercules Diesel Engines,** 6 cyl. Model DFXE, 199 HP at 1600 RPM. $2500 each.

A N D

Twelve Hall Scott "Invader" Gasoline engines, 6 cyl. Model 168, 200 HP at 1700 RPM. Used. $350 each.

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Long Beach 2, California

Special Offering

TWENTY 36' LANDING CRAFT LCPL-LCS TYPE Launches of Mahogany Plywood, suitable for water taxi, workboat, fishing boat, pleasure craft, used, with 200 HP Hall Scott engines. $700 each. Hulls only—$400 each.

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WANTED TO BUY

■ Will buy producing or non-producing Minerals or fee lands. Write full particulars: H. A. Hawthorne, Thibodaux, La.

NOTICES

■ **LEASE AND ROYALTY BUYERS always available for order buying in Louisiana and nearby states; write Original Leasing Service, Box 1606, Alexandria, Louisiana.**

■ KANSAS OPERATOR, MAJOR COMPANY EXPERIENCE LAND DEPARTMENT, WILL ACT AS AGENT CAPITAL SEEKING OIL INVESTMENT. Address: Box 10W, c/o World Oil, Houston, Texas.

HELP WANTED

■ WANTED—Geologist with at least six years' well completion experience in Texas Gulf Coast area. Address: Box 6, c/o World Oil, Houston, Texas.

WANTED: In Indiana, Michigan, Illinois, and Kentucky, sales commission representatives to sell and service well established line of tong-pull back springs, drill pipe wipers and protectors, shale or cement baskets, scratchers and centralizers. Applicants must have previous drilling or engineering experience, and also a knowledge of corrosion, cementing and pipe protection problems in area applying for

Weatherford Oil Tool Company
Personnel Department
P. O. Box 303, Weatherford, Texas

ASSISTANT SALES MANAGER: Large midwest independent needs young aggressive man with good experience in petroleum sales for position of assistant sales manager. Expanding operations require high type executive for this permanent position. In replying, give full details including age, education, and salary required. Replies confidential. Address: Box 24W, c/o World Oil, Houston, Texas.

ASSISTANT PROFESSOR to take charge of a newly created curriculum in petroleum production engineering in a southeastern university. Salary $3900 for nine months. Possibility of $900 more for summer work in research. Reply by letter stating personal data, education, experience. Address: Box 28W, c/o World Oil, Houston, Texas.

LAND AND LEASE MAN

I have position open in my New York office for an experienced, capable man thoroughly familiar with oil leases, drilling contracts, assignments and other phases of the drilling and producing business. Salary commensurate with ability. Write giving full particulars. Replies held confidential. Address: Box 25W, c/o World Oil, Houston, Texas.

WANTED - Land Man thoroughly experienced, by well-known independent oil company. Liberal salary with opportunity for rapid advancement. Give record of experience. Answers held confidential. Box 26W, c/o World Oil, Houston, Texas.

New Books and Maps

Production Statistics

Oil, gas and condensate production figures covering every field in the State of Texas are included in "Ira Rinehart's Production Statistics—Texas 1948." Figures are tabulated by fields, by months, and at the bottom of the column the cumulative production figure for each field is shown, as well as the number of productive wells in each field as of December, 1948. Green divider sheets separate the 350-page book into the 11 producing districts of Texas.

In the Introductory section a yearly and cumulative production record for the entire state (both oil and gas) is presented, and also a yearly record of wells drilled (oil, gas and non-productive) in Texas. Five areal maps are presented, showing the location of all Texas oil and gas fields; a state map shows the Railroad Commission districts, and counties contained in each district.

Rinehart Oil News Company, P. O. Box 1208, Dallas, $10.

Fair Trade Laws

"A Practical Guide to Fair Trade Laws" is the title of a book published by the American Fair Trade Council.

Featured in the reference work is a chart tabulating salient points of the Fair Trade acts in the 45 states that have such laws, a classification, by jurisdiction, of reported cases interpreting provisions of state and federal Fair Trade laws and a typical state Fair Trade law and unfair sales act. The book also contains a chapter reviewing the economic factors which make Fair Trade a weapon against price manipulation, typical wholesale and retail Fair Trade contracts and a capsule explanation of the "who," "what" and "how" of Fair Trade.

The American Fair Trade Council, 11 East 44th Street, New York 17, $2.50.

Petroleum Transportation

To help provide a better understanding of the complex job involved in moving two billion barrels of crude oil annually from the wells to the consumer, the API has published an illustrated map showing the routes of pipe lines and the transportation equipment used by the nation's oil men.

Finished in three colors, the map gives visual significance to the huge transportation system erected by the oil industry to keep the American public well supplied with petroleum products everywhere.

In addition to the illustrations, it also carries a thumbnail history of the growth and development of petroleum transportation in the U. S.

The pipe line routes are super-imposed on a map of the U. S. White lines are used to indicate the crude oil pipe lines, and red ones indicate the finished product pipe lines. A blueprint-type chart pictures the standard tankers, barges, tank trucks, railroad tank cars and pumping stations used in oil.

For a free copy, write Department of Information, American Petroleum Institute, 50 West 50th Street, New York 20. Additional copies, 10 cents.

Tool Joints and Drill Collars

A factual presentation of the tool joint and drill collar failures most likely to worry the present-day operator is contained in a new brochure, "Care and Operation of Tool Joints and Drill Collars." The most satisfactory methods of reducing these troubles are the conclusions drawn by a staff of tool joint experts through engineering and field research over a period of years.

Since modern advances in tool joint design and construction have largely eliminated the former failures of tool joint to drill pipe connection, the text of the book deals with tool joint troubles in pin and box connection. Operational practices which will eliminate the common causes of pin and box failures are discussed.

Subjects covered in the book are breaking in new tool joints, general operating recommendations, galling or "freezing," "wobbles," operational damage, outside diameter wear, operation under extreme torque conditions, and repair of damaged tool joints.

Written in the language of the drilling industry, purely technical engineering terms have been kept at a minimum. Photographs illustrate each point or process dealt with in the 38-page monograph.

Hughes Tool Company, P. O. Box 2539, Houston 1.

SITUATIONS WANTED

■ **Position wanted with large independent producer, who is doing own drilling, or with progressive drilling contractor as drilling Engineer or Superintendent. Have fifteen years experience in various phases of drilling and engineering including directional drilling, mud engineer, formation testing, electrical and mud logging. Couple hundred hours as private pilot. Capable of handling and planning drilling costs. Thirty-nine years old, married, sober. Will furnish excellent references. Minimum starting salary considered $7200.00 annually. Address: Box 9W, c/o World Oil, Houston, Texas.**

■ **I would like to design and lay-out a hydraulically operated power swivel for an oil tool concern on a part-time or free-lance basis. Box 27W c/o World Oil, Houston, Texas.**

■ **Experienced operator can handle part time lease and royalty buying accounts in Gulf Coast States. Box 15W, c/o World Oil, Houston, Texas.**

LEASES, DRILLING, ACREAGE, ETC.

■ SEE A. L. BOWLES, ADA, OKLAHOMA, FOR SHALLOW DRILLING DEALS IN OKLAHOMA.

■ Recent strikes have focused attention on Montana's deeper oil zones and major companies are moving in fast, drilling and leasing. We buy direct in the field, sell direct to our customers. Write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

■ For Leases, Minerals and Royalties, West Texas, Write Onas Ferguson, 1411 West Tennessee, Midland, Texas.

Who's Who in the Oil Industry

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10 pocket-size, plastic-bound personnel directories covering the entire oil industry. Over 43,000 key men are listed. First seven books cover Producing and Drilling Contracting.

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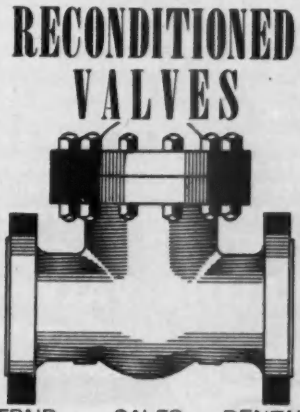

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SQUEAKS from the BULLWHEEL

Sweet and Low

The hare-lipped man fearfully approached the plastic surgeon. "Doc, I want m' face straightened out but how'm I gonna eat while it's gittin' well?"

"Oh, never fear. We'll feed you intravenously. You know—stick a needle in your vein."

"Omigosh, no! That'll hurt. I'm afeared o' being hurt."

"Well, in that case we'll feed you through the rectum. As a matter of fact, old fellow, I'm getting ready to have a cup of coffee right this minute. Suppose you have one with me and I'll prove that it doesn't hurt."

(Time out while everybody gets ready.)

The action commences and—"Hey, Doc! Doc! Stop! Quit!"

Now, now. You know that doesn't hurt you!"

"No, Doc. It don't. But there hain't no sugar in it!"

Rest a Spell

The new tool pusher was named Dodgin. He climbed out of his car for his first look at the new wildcat and came upon two of the crew in back of the core house smoking.

"Who are you?"

"I'm Dodgin, the new tool pusher."

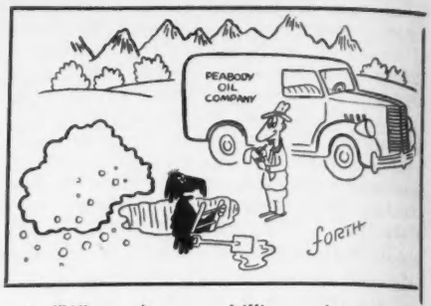
"So are we. Sit down and have a smoke."

Natural Wonder

A couple was driving across the Mojave desert and saw a tiny black speck in the distance which turned out to be a man wearing his swimming trunks.

The man hailed them and said, "How far is the ocean?"

Somewhat surprised, the couple explained that the ocean was a few hundred miles away on the other side of California. "Good Lord," said the man, staring at the sandy waste, "what a beach."



"Why can't we use drilling equipment like other companies?"

Handy Gadget

Two old mountaineers were sitting on the porch and one was showing the other his gun. As his friend looked at the rusty old relic admiringly, the owner went on, "That gun has killed more game, possums, coons, groundhogs, squirrels, quail and stuff like that. . . . And what's more," he added under his breath, "it's got me two son-in-laws."

Just a Bum

A student nurse in a hospital recently wrote a letter to her mother. On getting the missive, her mother was badly upset.

"I don't understand it," she moaned. "We send our daughter a good allowance, and yet she writes home that she had to do a lot of panhandling this week."

It All Depends

A Pullman porter who had started out on an all-night run had his trip canceled. Returning home unexpectedly he looked around the house, then took out his razor and began to strop it vigorously.

"What you doin', Jackson?" asked his wife.

"If those shoes stickin' out from under the bed ain't got no feet in 'em, I'm goin' to shave."

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2. **SIMULTANEOUS FIRING** under all conditions gives exact spacing of shots, perfect perforation pattern, and saves down-the-hole time.
3. **ACCURATE DEPTH MEASUREMENTS** put the shots right where you order them.
4. **MAXIMUM PENETRATION** of bullets into the formation, as proved repeatedly in competitive field tests.
5. **GUNS TO FIT EVERY CONDITION.** McCullough employs more than 30 different types and sizes of guns.
6. **ALL SIZES OF BULLETS** from ½" dia. up to ¾" dia., to fit every possible need.
7. **BURRLESS BULLETS,** giving a completely burr-free hole, eliminating casing scraping, with *no* sacrifice of penetration.
8. **NO LOST TIME.** McCullough's simpler, lighter equipment cuts setting-up and moving-out time, speeds up every job.
9. **EXPERIENCED MEN.** With years of experience behind them, thoroughly-trained McCullough gun-perforating crews do their jobs quickly, efficiently, safely.

These Are Some of the Reasons Behind the Proven Fact That

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10 This is a section of a McCullough **90-SHOT GUN** perforating a 15-foot section with 6 holes to the foot, at one run.

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CALIFORNIA: Los Angeles, Avenal, Bakersfield, Ventura

MONTANA: Cut Bank

LOUISIANA: Houma, Lake Charles, New Iberia, Shreveport

WYOMING: Casper

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

Flashes from the BEACON

STOP THE PRESS—HERE'S REAL NEWS! The BS&B BEACON press just **had to stop while** the editor clacked out a news flash guaranteed to warm the hearts of oil men everywhere. The Board of Directors of Black, Sivalls & Bryson has named Budd Parks an Executive Vice President of the corporation. Budd, known and loved in the oil country through his 28 years of oil field service with BS&B, has more well-wishers than a centipede could count on his toes! Watch for Budd's story in the BS&B BEACON.

* * *

And while we're spreading joy, may we of the BEACON staff take one small quick modest bow from the waist? The BEACON was a first prize winner in the 1949 International Industrial Publications Contest sponsored by the International Council of Industrial Editors. Editor Marje Sweeney accepted the coveted award on behalf of the staff at the Council's world convention in Toronto, May 10.

* * *

The life and times of the bass—most sport-provoking of inland fish—comes in for thorough scrutiny when Milford Waddell, BS&B's industrial and public relations director—and serious fisherman, presents **"Bass Fishing"** in the BEACON. While you're scrambling through your bait box, remember—we warned you!

* * *

Inside and outside slants on national sports come your way through the eyes of Lloyd Young and Hal Fessler each month . . . where? In the sports section of the BEACON.

* * *

One of the most widely-praised company magazines, the BS&B BEACON is mailed without charge to those who enjoy it.

* * *

A request on your company letterhead will do the trick.

Write to:

BLACK, SIVALLS & BRYSON, INC.

Industrial and Public Relations Division
720 Delaware
Kansas City, Missouri

SQUEAKS from the BULLWHEEL

Big Talk

Every day about sundown Lone Tailfeather, an unhappy New Mexican Indian, would climb to the top of a mesa, build a fire, and send smoke-messages to his lady friend, who lived on the next mesa. The romance was proceeding slowly, because Lone Tailfeather, albeit brave and bold, was a poor conversationalist.

One day Air Force planes flew over the desert between the two mesas and dropped an atomic bomb. "Gosh!" said L. T. as he watched the giant mushroom of billowing smoke. "I wish I'd said that!"

Right Behind You

Said the girdle to the hat: "You go on ahead, I'll bring up the rear."

Contagious

Judge: "What possible reason does the jury give for acquitting this man?"
Foreman: "Insanity, your honor."
Judge: "All twelve of you?"

Sure Test

Some visitors were being shown through an insane asylum. They inquired of their guide what method was used to determine which patients were sufficiently recovered to leave.

"Well, we have a big trough of water and we turn on the tap and tell the inmates to bail the water with pails until they have emptied the trough."

"What does that prove?"

"Well, anyone that isn't crazy shuts off the tap."

Times Have Changed

A visitor to an asylum asked an inmate his name.

"George Washington."

"But the last time I saw you, you were Abraham Lincoln," the visitor said.

"That," replied the inmate sadly, "was by my first wife."

Escalator Clause

Question: The bus driver charged a lady full fare for her son who was wearing long pants. At the next corner, a small boy wearing short pants paid only half fare. And, at the next stop, a lady mounted the bus and driver didn't charge her anything. Why?

Answer: She had a transfer.

High-Flyer

Two buzzards soared lazily over the desert when a jet propelled plane zipped by them, its exhaust throwing flame and smoke. As it whizzed out of sight, one of the buzzards remarked, "That bird was really in a hurry."

"You'd be in a hurry, too," said his companion, "if your tail was on fire!"

No Finesse

First Cow: "What do you think of the new farm hand?"

Second Cow: "I think he's an awful jerk."